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SPE JOURNAL

VOL. 10 September, 1954 No. 7

Published monthly except July and August by

THE SOCIETY OF PLASTICS ENGINEERS, INC.

30 cents a copy $3.00 per year

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JESSE H. DAY, Editor

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Greenwich, Conn.

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ATHENS, OHIO

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• *All correspondence dealing with business matters, membership, advertising and the like should be addressed to P. J. Underwood at the Business offices listed above.*

• *All copy intended for publication in the SPE Journal should be directed to the Editorial Offices. Copy for each issue should be received at the Ohio University, Athens, Ohio, before the first of the preceding month. Neither The Society of Plastics Engineers, nor the SPE Journal are responsible for the views expressed by individual contributors.*

• *Entered as second-class matter at the Post Office at Athens, Ohio.*

M. B. Crawford, west coast plastics sales manager for the Naugatuck Chemical Division, United States Rubber Co., sits at the wheel of Naugatuck Chemical's new plastic car, the Alembic II. The body, molded in one piece, weighs only 225 pounds. It fits any chasis with a 101 inch wheel base. It was made by the Glasspar Company, Santa Ana, California.

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Book Reviews . . . .

MANUAL FOR PLASTIC WELDING, by Haim and Neumann. Published by Industrial Publishing Co., 1240 Ontario St., Cleveland 13, Ohio. Price $6.00; 128 pages.

This book gives a complete, straightforward and practical account of how to weld polyethylene. The chapter titles give a good outline of the contents; What a Welder Should Know About Plastics; Polyethylene, its history and development; Commercial Forms of Polyethylene; The History of Welding Plastics; Equipment; Details of the Process; Types of Welds Suitable for Polyethylene; Layout for a Workshop for the Welding of Plastics; General Rules for the Working of Polyethylene; Lining of Tanks with Polyethylene; Polyethylene Pipe Lines; The Scope of Polyethylene Fabrications and Applications in Industry; Selecting the Right Man for Training.

Chapter 14 is a detailed series of ten lessons for training a man to weld polyethylene by hot gas welding.

Altogether a practical book, with many illustrations and photographs, no detail of polyethylene welding technique is omitted. If you are engaged in welding or fabrication of ethylene polymers, this book is a must.

J. H. Day

ARTIFICIAL FIBRES; by Moncrieff, published by John Wiley, 440 Fourth Ave., N. Y. 16, N. Y. The second edition contains 455 pages and is priced at $6.00.

The complex processes of making plastics into cloth are fascinating reading—and on the basis of general interest alone Artificial Fibres is worth reading. For example; aluminum alginate fibres char but do not flame, clothes made from them can be dry-cleaned but dissolve in slightly alkaline soap solution! Give you ideas? It sure gives the weaver ideas—he can weave a fabric using heavy alginate yarns and very light worsted yarns, then wash away the alginate to leave a worsted so fine that it could never have been woven directly!

Rapid developments in the field have prompted an early revision of Moncrieff's "Artificial Fibres." Published in April, the second edition provides the salient facts about all fibres produced, including those used on a relatively small scale.

This comprehensive volume, expanded almost fifty percent, covers the new fibres such as Acrilan, X-51, Merinova, Fiber E, Rhovyl, Vinylon, and gives more attention to dyeing methods and staple blending. He has also added an entirely new chapter on the economic and social aspects of artificial fibre production.

After surveying the general structure and properties of fibres, the author elaborates on regenerated cellulosic, alginic, protein, and synthetic fibres, from the standpoints of their history, chemical nature, manufacture, properties, dyeing, and uses. A substantial part of his final discussion centers on the processing of fibres.

Robert W. Moncrieff was recently with Alginate Industries Ltd. as a development officer and was formerly a research chemist with British Celanese Ltd.

SET SAIL FOR ATLANTIC CITY!

Across the Editor's Desk . . . .

• A very valuable tool for the plastics molder is one that would enable him to produce better parts at smaller expense and minimize rejects. Such a tool is statistical quality control— but till now there has been no way to learn how to use it except for mathematical wizards. That has now been changed—a series of articles, aimed at the molder, starts in this issue of the SPE Journal. The articles are designed to take up the subject from the beginnings and carry on till the **how** and **what-to-do** are explained. If you are not now using S.Q.C., here's your chance to learn the easiest way possible.

• **Set Sail for Atlantic City!** The Eleventh SPE Conference is set for Atlantic City next January 18-21, 1955. For a first look at the plans, turn to the story on page 17.

• Executive-Secretary P. J. Underwood is now well established in the new executive and business offices at 34 E. Putnam Ave., Greenwich, Connecticut. Editorial offices remain at Ohio University, Athens, Ohio.

• We don't need a crystal ball to predict some unusually fine and important articles in the SPE Journal in the near future, because we have some of them already typeset and waiting for space. See the next issues for more detail!

• Members of SPE are invited to the "Societe de Chimie Industrielle" at Brussels, Belgium, to participate in the 27th International Congress of Industrial Chemistry to be held in Brussels from the 11th to the 19th of September 1954. Further information may be had by writing the Belgian Consulate General, 630 Fifth Ave., New York 20, N. Y.

Naval Ordnance Seeks Plastics Engineers

At the present time the U. S. Naval Ordnance Test Station at Inyokern, China Lake, California, has several openings in the fields of Chemical and Plastic Engineering. Areas of work include the study of the mechanical and physical properties of such solid propellant materials as those based on nitro cellulose and similar materials, applied research, development and experimental production in the fields of explosives and propellants and the development of rockets and propulsion systems.

Salaries would be based on the applicant's experience and training and would range from $3410.00 to $7040.00 a year as base pay.

Applicants are invited to contact this office for further information or to submit a Civil Service Form 57 (application) which can be secured at any first or second-class post office.

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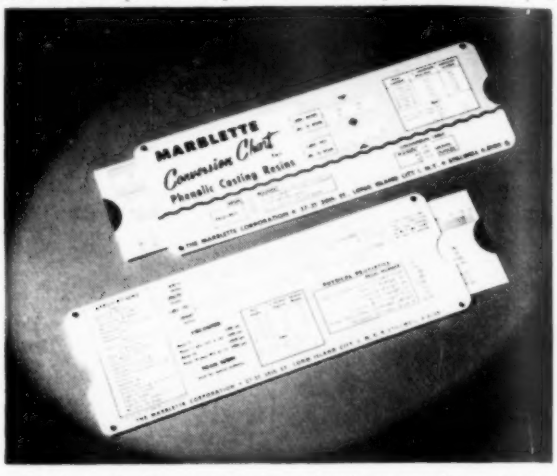
Write The English Mica Co. . . . of 79 Prospect Street, Stamford, Connecticut for information on the Finer Ground Micas and U.S. Mica Co., Inc., Jordan & Van Dyke Streets, East Rutherford, N.J. on the coarser Ground Micas.

Computer for Cast Phenolics

A conversion chart that does away with "computation headaches" in using phenolic resins to cast industrial parts and consumer items is now being made available by the Marblette Corp., 37-21 Thirtieth St., Long Island City 1, N. Y.

The production guide was created to Marblette specifications by the Perrygraf Corp. It utilizes the slide-rule principle to show at a glance the amounts of resin and accelerator required to produce a cast phenolic of any size.



Copies of the conversion chart, as well as technical information and production samples for specific applications, are available on request to the offices of the Marblette Corp.

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BAKELITE Elastomeric Plastics are being used for many decorative and functional applications—women's belts, auto weatherstripping, typewriter platens. They have excellent dielectric properties, demonstrated by 15 years' successful use as insulation for electrical wire and cable. For information and help in applying them to your product ideas, write Dept. XW-43.

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Belleville, Ontario

Industrial Literature . . .

A Plastics Bibliography

Five authorities in the field have prepared a summary of 1952-1953 developments in plastics, based on 228 published articles.

Their findings, along with a complete bibliography, appear in the August issue of "Mechanical Engineering," official publication of The American Society of Mechanical Engineers.

The authors, all of Pennsylvania Industrial Chemical Corporation, Clairton, Pa., report a few new materials. Among these are triallyl cyanurate, a monomer for cross-linking resinous materials, and chlorosulfonated polyethylene, which has attracted considerable interest because it can be cured and is resistant to ozone. Vulcollan, a polyester cross-linked with isocyanates, has been found to give outstanding wear in tires.

For reprints of this bibliography, write to:
The American Society of Mechanical Engineers
29 West 39th Street
New York 18, New York

Temperature Measurement

"How Temperatures Are Measured" by Dr. G. M. Wolten is an interesting and informative discussion of a subject about which there is a great deal of misunderstanding and confusion even among the technical fraternity. It was originally prepared for the house organ of one of our leading laboratory supply houses, and the comments on the article have been so favorable that we feel it deserves wider distribution. Some of the topics covered are:

1. Heat and temperature as separate concepts.
2. History of the commonly used scales for measuring temperatures.
3. Physical effects associated with a rise in temperature; how thermometers and pyrometers utilize some of these effects.
4. Monitoring surface temperature by means of changes in color or physical state.

We will be glad to supply copies of the enclosed reprints to your readers who desire them—gratis, of course. Write to:

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"Now Constant Tension From Start To Finish In Winding Roll-Fed Material," is the title of a four-page folder just issued on the new Hobbs "Alquist" Winder by the Hobbs Manufacturing Company. Copies of this folder can be obtained without obligation by writing to Hobbs Manufacturing Company, Dept. 315, 26 Salisbury Street, Worcester 5, Massachusetts.

Thermocouples and Packing Glands

The new Conax Thermocouples and Packing Glands Catalog 1530, is just off the presses. This new catalog completely illustrates and describes the full line of Conax products including Bare Wire Thermocouple Glands, Packing Glands, Protection Tubes, Quick Disconnect Thermocouples and C-U-P (change-under-pressure) Glands. Write to:

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Lustrex Hi-Flow 55 styrene molds at 25° to 50° F. *lower* than general purpose styrene!

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Faster cycles give you easier, more economical production—cut your costs and increase your profits. Yet you maintain quality control, because the lower cylinder temperatures and pressures result in pieces with less strain.

Many uses!

Lustrex Hi-Flow 55 styrene is perfect for packaging and food containers, also for pin-point gating and thin-wall applications where general purpose styrene may have difficulty in filling. It is also ideal for thick-section pieces such as brush backs, and other deep-drawn applications.

Suitable for your equipment!

Works equally well in standard injection, compression and extrusion machines.

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For complete details on Lustrex Hi-Flow 55 styrene molding powder, write: MONSANTO CHEMICAL COMPANY, Plastics Division, Room 2907, Springfield 2, Mass.

H-P-M Announces New 20-28 Oz. Plastics Injection Molding Machine

In certain classes of injection molding work, such as table model radio cabinets, toys, refrigerator parts and house wares which were formerly molded on 16 oz. equipment, there has been a trend toward larger size parts. To accommodate this trend, The Hydraulic Press Mfg. Company (H-P-M) announces a new 20-28 oz. injection machine having many outstanding new features, but selling in the 16 oz. price range. This machine was shown at the recent National Plastics Exposition.

For more complete information on the new H-P-M Model 400-H-20, write The Hydraulic Press Mfg. Company, Mount Gilead, Ohio, U.S.A.

Atomics Used to Find Mold Wear

The General Electric Company's Chemical Materials Department announced today what is believed to be the first peacetime application of atomic energy to the plastics molding industry. Radioactive tracer techniques have been developed by G-E engineers to precisely determine the erosion in molds caused by plastic compounds, a problem that has plagued the industry for many years.

Polyester Release Compound

Polyester Release Compound P-1 is a solution of polyvinyl alcohol, pigmented green to make the film visible. It spreads well over any type surface, and dries to a continuous, flexible, strippable film. Available in 1, 5, and 55 gallon containers. Samples on request. Write to:

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Please advise if you are interested in temperature control for molds or for rolls. Bulletin and case histories will be mailed to you by Sarco Company, Inc., Empire State Building, New York 1, N. Y.

Vinsol Resin Booklet

A revised technical booklet which illustrates how low-price Vinsol resin may be used to reduce the cost of phenol-formaldehyde resins is now available from Hercules Powder Company, 930 King St., Wilmington, Delaware.

Glass-Silicone Laminate

Data on Formica's new glass-silicone laminate may be had by writing Perry-Brown, Inc., 2831 Vernon Place, Cincinnati 19, Ohio.

Mylar Described in Brochure

Mylar, DuPont's polyester film is described in a booklet which may be had by writing Jack Isbell, Public Relations Dept., Du Pont, Wilmington 98, Delaware.

Structural Adhesives

Two new structural adhesives for bonding metal-to-metal and metal-to-plastic—one offering extremely high strengths at normal temperatures, and another offering extreme flexibility at elevated temperatures, have been developed by Rubber and Asbestos Corp., Bloomfield, New Jersey.

Originally developed for aircraft structural applications, these new formulations appear to offer widespread applicability to regular civilian industrial production needs.

Book on Alcohols Available

A new 52 page book describing alcohols — a family of chemicals used in many branches of the manufacturing and process industries — has just been published by Carbide and Carbon Chemicals Company, a Division of Union Carbide and Carbon Corporation. This book discusses in detail the 20 alcohols that are now sold in commercial quantities by the Company.

Copies of this new book, "Alcohols" (F-4731), are available from Carbide and Carbon Chemicals Company, 30 East 42nd Street, New York 17, New York.

Automatic Injection Machine

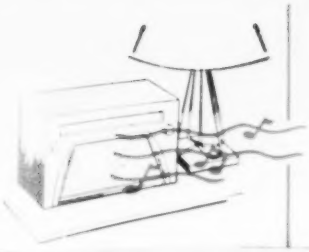
Improved Machinery, Inc., Nashua, New Hampshire, has for some time been developing a new automatic injection machine. Several have been built and are now going through paces and shake-down stages on a production basis.

The machine has many features not normally found in small machines. For example it has 15-inch die stroke and a 30-inch open daylight. This stroke can be adjusted down to 3 inches. It has a 65-ton full hydraulic clamp, will inject up to 2 ounces of polyethylene and 3-ounces of polystyrene at an estimated rate of about 60 pounds per hour.

Engineering Case Studies

Brochure of engineering Case Studies, recently released by Dravo Corporation, Pittsburgh, Pa., describes a variety of successful applications of conventional warm air space heaters to the job of industrial proces drying.

Featuring installations for curing rubber, and drying ceramic, paper, lumber and woven products, the studies explain the methods followed in applying the heaters to different types of drying systems. This information, together with listed benefits derived at each plant, provides a wealth of useful data on the subject of process drying.



They needed a plastic to make strong, heat resistant radio parts

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MC-305	"High Impact," Easy Flow
MC-309	"High Impact," Highest Heat Distortion Temperature
MC-405	"Medium Impact," Easy Flow
MC-409	"Medium Impact," Highest Heat Distortion Temperature

• Most people treat radios with care, but accidents do happen. Take small radios, the kind you use in the breakfast nook or at the bedside. They're often jarred or bumped, so they have to take shock and impact.

Heat is another problem with small radios. They're often carried outside in the hot sun, or they sit near a window where the sun pours in. Both this external, and the internal heat generated by the radio, tend to make some plastic radio cabinets warp out of shape. That's why leading radio manufacturers have been looking for plastic parts that can take both bumps and heat. They found what they wanted in Koppers Heat Resistant—High Impact Polystyrenes. These plastics contain *rubber*, which makes the polystyrene strong and durable.

New radio cabinets, dials and knobs made with these plastics come in bright colors. They are light weight and have smooth, easy-to-clean surfaces.

Koppers Heat Resistant — Heat Impact Polystyrenes have production advantages, too. They are dimensionally stable and flow easily in the mold.

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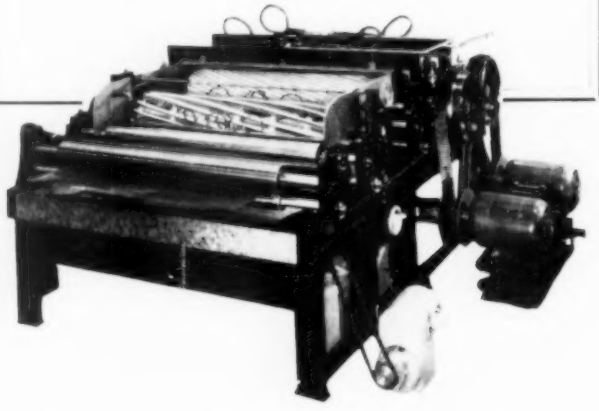

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Teflon Fiber

A complete description of "Teflon" tetrafluoroethylene fiber—a new fiber so resistant to heat and chemicals that laboratory workers call it "dragon fur"—was presented today by the Du Pont Company for the first time.

In a booklet prepared for distribution at the Basic Materials for Industry Exposition in Chicago, the company's Textile Fibers Department said "the unique chemical and physical properties of this fiber at elevated temperatures and pressures make possible operational performance undreamed of before."

Produced only in experimental quantities at present, "Teflon" fiber is being evaluated strictly as a tool for industry. It was emphasized that there are no textile apparel uses envisioned for the fiber at this time.

Radioactivity for Plastics

A Symposium on the Applications of Radioactivity in the Rubber and Plastics Industries will be held in Boston at the Sheraton-Plaza Hotel, October 6th through 8th, under the sponsorship of the Technical Division of Tracerlab, Inc.

The aim of the Symposium is to acquaint members of the plastics and rubber industries with the past uses, and possible future applications, of radioisotopes in research, development and process control.

The first day will be devoted to orientation talks directed to those persons who are contemplating the use of isotopes. Lectures on the fundamentals of radioactivity, establishing a radioactivity laboratory, AEC regulations, health physics problems, training of personnel, and other basic topics will be given.

The second and third day will be taken up by technical papers presented by outstanding speakers from industry, academic research institutions and the Atomic Energy Commission. The speakers will present original papers and lead discussions on such topics as the kinetics of polymerization, initiation of polymerization by ionizing radiation, wear tests, migration and self-diffusion and liquid level and thickness gauging.

The registration fee will include admission to all sessions, abstracts of talks, and a dinner preceded by a cocktail party on October 6th, featuring a speech by a nationally prominent figure in the field of atomic energy.

Further information can be obtained by writing the Symposium Committee, Technical Division, Tracerlab, Inc., 130 High Street, Boston 10, Mass.

Norway Exhibit

In connection with the International Plastics Exhibition in Oslo (October 5th-17th, 1954) a conference will be arranged from October 7th-9th, 1954.

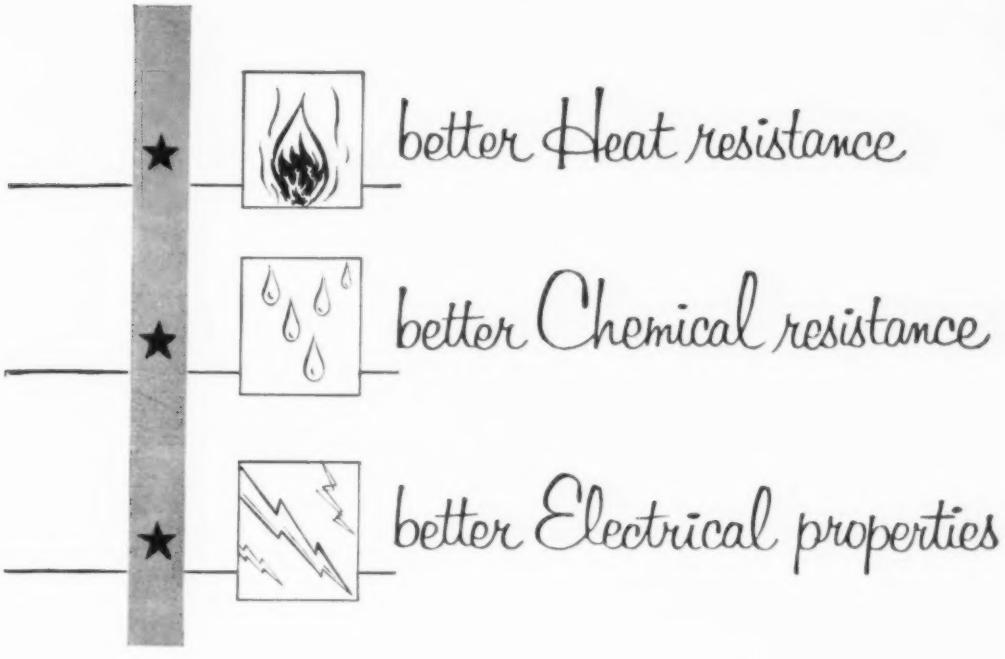
The conference will include technical lectures about present problems in different plastic fields and discussions by foreign experts, economics lectures with discussions especially with relation to Scandinavian problems, excursions, a special programme for accompanying ladies, and a banquet.

The Secretariat will be of assistance on request in arranging hotel accommodation. Due to the difficult hotel situation, however, we advise all participants to inform the secretariat about their wants as soon as possible, and not later than August 31st, 1954.

Write to the Secretariat: Forening for Norsk Plastindustri, Munkedamsveien 53 B, Oslo.

Important news!

EPON® resin 828 with new Curing Agent CL gives



If you are among the many users of Epon resin 828 for casting, laminating or other structural applications—you will welcome this new development of Shell Chemical's continuing research program.

Curing Agent CL* produces Epon resin polymers with improved mechanical and electrical properties at temperatures as high as 300° F. After three hours' immersion in boiling water or acetone, glass cloth laminates of Epon resin 828 and Curing Agent CL retained more than 95% of their initial dry flexural strength. And with Curing Agent CL you can use the "B-stage," or pre-curing, process—permitting dry layups and specialized casting techniques.

Your request will bring you a sample of Epon resin 828 and Curing Agent CL for evaluation, as well as a copy of Technical Bulletin SC:54-10. Write for them—today.

Curing Agent CL is Shell Chemical Corporation's name for metaphenylene diamine. We do not manufacture Curing Agent CL. It is available in commercial quantities from E. I. du Pont de Nemours & Company and National Aniline Division, Allied Chemical & Dye Corp.

*A development of Shell Chemical laboratories. Patent applied for.

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From the mold shown, Bridgeport Moulded Products Co., Inc. produced the handsome grille of the Philco air conditioner pictured in the inset—one of the hundreds of fine products for which molds have been created by the skilled hands and modern facilities at Newark Die Company.

Big molds have been a big factor in the growth of the plastics industry. For more than 30 years Newark Die has led in the design and construction of all types of molds.

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NDCO TRADE MARK

YOUR NATIONAL OFFICE

The Society's membership goal, set by the National Board of Directors in September, 1953, is 5000 which represents an increase of approximately 2300 over our October 1, 1953 membership.

To date, 800 new applications have been received — ⅓ of the number necessary to reach our goal. And our over all membership has exceeded 25% in growth in 10 months!

The Canadian Sections have far outdistanced all other sections in percentage increase. Among the smaller sections South Texas has shown considerable activity with a 63% increase in membership and New York's growth of 44% is way ahead of the other larger sections.

How does your section's record compare?

Sincerely

P. L. Underwood

Executive Secretary

SECTION MEMBERSHIP COMPETITION

	Membership	New Applicants			
	Oct. 1, 1953	Oct.-Jan.	Jan.-Apr.	Apr.-Aug.	% of Goal
Baltimore-Washington	49	1	4	1	12
Buffalo	65	5	3	2	15
Central Ohio	33	1	2	4	21
Chicago	315	21	13	7	13
Cleveland-Akron	148	17	16	—	22
Connecticut	86	7	8	7	26
Detroit	173	13	16	9	22
Eastern New England	132	5	13	6	18
Golden Gate	32	5	5	—	32
Miami Valley	102	2	5	1	8
Milwaukee	1	—	22	3	—
Newark	321	31	17	14	19
New York	248	22	50	38	44
Northern Indiana	21	1	4	—	24
Northwest Pennsylvania	75	8	3	2	17
Ontario	43	23	31	12	130
Philadelphia	174	9	23	12	25
Pittsburgh	6	8	5	3	—
Quebec	25	16	11	—	108
Rhode Island & SE Mass.	68	4	3	6	19
Rochester	65	10	8	3	32
St. Louis	71	13	6	2	29
Southeastern Ohio	36	4	3	2	25
Southern California	96	15	13	5	34
Southern Section	3	—	43	11	—
South Texas	32	6	7	7	63
Toledo	59	0	1	2	5
Upper Midwest	54	5	5	—	19
Western New England	135	15	20	6	30
Non-Section	33	0	8	1	—
TOTALS	2704	267	368	166	26

GRAND TOTAL—3505

Wonderful way to handle kitchen tools!

MELMAC *handles molded for Ace Products Company, Chalfont, Bucks County, Pa., by Northern Industrial Chemical Co., South Boston, Mass.*

MELMAC makes handles with a quality look and feel . . . durable . . . resistant to heat, washing, discoloration!

Heat- and flame-resistant plastic handles are a sales feature of these new Ace and Luxor stainless steel kitchen tools. Molded of MELMAC melamine-formaldehyde – the same material used for molding beautiful, break-resistant dinnerware–these handles withstand washing in automatic dishwashers without distortion or loss of luster. And the more they are handled the better they are! The appearance of MELMAC actually improves with handling.

What's more, MELMAC gives handles a *quality look*. On these kitchen tools, for example, MELMAC handles are available in an attractive grained effect resembling walnut wood, a striated ivory MELMAC having the appearance of antique bone ivory, and jet black.

Remember–whenever you make a product that is to be handled, there's *no* surface like a MELMAC surface for appearance and durability! Interested in how MELMAC can help you handle *your* products better? We'll be glad to tell you more.

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Set Sail for Atlantic City

Eleventh SPE Technical Conference Plans

Atlantic City, New Jersey, January 18 Through 21, 1955

"Growth Through Engineering"

Program Chairman (and former National President) Bill Bracken and his committee have planned an information-packed agenda with industry-wide discussions of best applications of plastics to products in light of new developments, as well as down-to-earth symposia on recent developments in such fields as vacuum-forming, chloro- and fluoroethylene plastics, silicone resins, reinforced polyesters, and hot-runner injection molding. Each symposium will have a moderator with diversified experience in his field and speakers with specialized knowledge of the particular phase of the subject under discussion.

The talks will be meaty and straight-forward, with an average time allowance of only 30 minutes per speaker, including question and answer period.

The conference committee would like to thank the membership for its whole-hearted support as reflected in the response to the questionnaire mailed early in the summer. Suggestions for topics for technical papers are being studied, with special emphasis on those subjects of greatest interest to the members.

The Chalfonte-Haddon Hall Hotel (Atlantic City's finest) is exclusively ours for this conference, which will result in something truly unique in Technical Conferences. Everyone you see or meet, even outside the meeting rooms, will be a fellow member or guest in attendance. Members will never have a better opportunity to renew old friendships, enjoy informal discussions, and increase the number of their acquaintances in this congenial and club-like atmosphere.

This year, more members than ever before have indicated they intend to bring their wives along for that much-needed winter vacation just after the hectic Christmas Holiday season. The Ladies Entertainment Committee are planning a complete program for the Ladies, with something interesting and fun to do every minute.

A fashion show and special ladies luncheon will occupy part of one day, while the men are having their business luncheon.

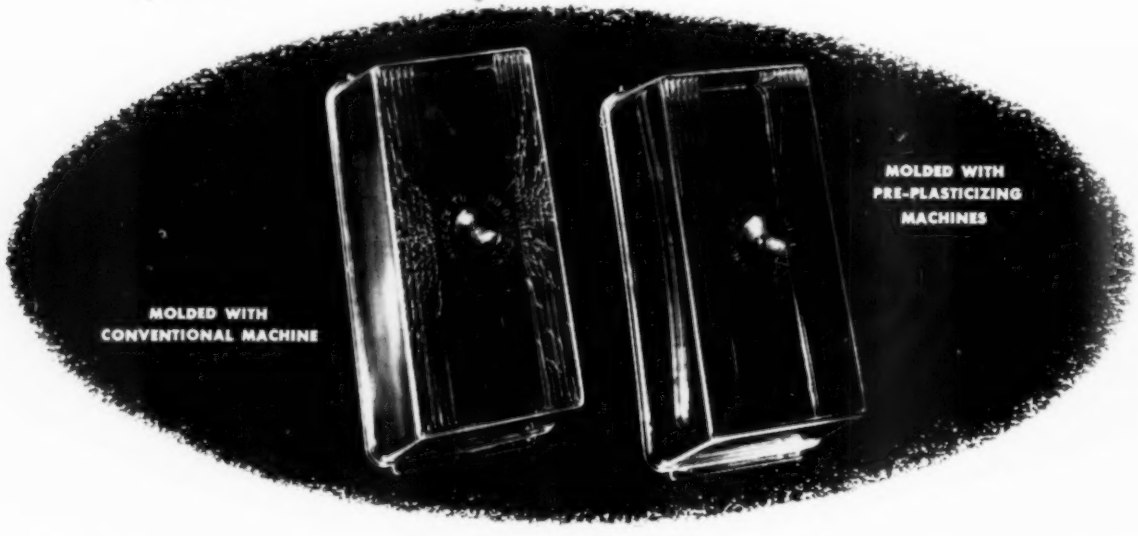
There will be several short day excursions by special bus which the Ladies may take at their individual option, such as a trip thru the factory of the company which makes the finest china this side of the Atlantic, and supplies the White House with the Presidential china. Also available will be the famous board-walk shops, and the finest in food and entertainment for which Atlantic City is world-famous. The climax of course will be the banquet and dance on the last evening, and each lady will receive attractive and useful prizes.

A great many members, particularly those from more distant points, have indicated interest in traveling in a group with others from the area. This has been found to be extremely pleasant in the past by those who have participated. In response to this demand a Transportation Chairman will be appointed for each section more than 150 miles distant. Special planes will be provided which will fly directly to Atlantic City, thus saving transfer time at air terminals enroute. For those who prefer to travel by train, Pullman cars will be reserved in the larger cities, and in many cases, routed straight thru to the conference. Members interested in taking advantage of this group travel plan should contact their section President or Vice-President who will give them the name of the Transportation Chairman. It is hoped that the Vice-President of each section will agree to serve as Transportation Chairman and handle local arrangements. All airlines and railroads will be furnished with information from conference headquarters enabling them to carry the major part of the burden.

In view of the enthusiastic answers received to the questionnaire, and the ideal location of the conference, it is expected that attendance will run at an all-time high and the occasion will prove most satisfactory and successful.

WILL YOUR PARTS PASS

The Heptane Test?



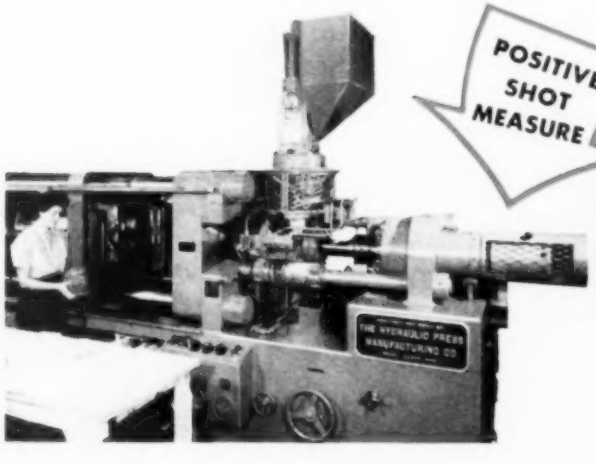
H-P-M Pre-Plasticizer *Guarantees* High-Strength, Strain-Free Parts!

Dipping molded parts in Heptane solution gives you visible evidence of any strains that may be present in the molded piece. Buckeye Molding Company, famous as producers of Flexeel containers, proved that their H-P-M 48 oz. pre-plasticizers give them strain-free parts on this job.

On this refrigerator dish, injected in a 4-cavity mold, Buckeye increased production 67% . . . achieved 25% better quality . . . and scrapped only 18 parts in a 24 hour period.

Now equipped with a positive shot measuring device, H-P-M's model 400-P-48 provides zero injection pressure after the mold cavities are filled. There is no chance of "packing". Mold release compounds are no longer required! No other machine offers you this feature!

Yes, H-P-M pre-plasticizers will give you deeper draws . . . faster cycles . . . better dry-coloring . . . lighter weight parts . . . less part distortion . . . a greatly improved product . . . plus proven savings in production costs. Write for full details today!



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Part I of a Series presented by the Quality Control Committee, S.P.E.

L. M. Debing

L. M. Debing

Chairman of SPE Committee on Statistical Quality Control
Member of American Society for Statistical Quality Control

Monsanto Chemical Company
Springfield, Massachusetts

This is the first in a series of articles designed to describe the ways to use statistical quality control for the plastics molder. The articles begin at the fundamental level, so that the whole series can be read and used, even if the reader has no previous knowledge of statistics nor the time to wade through a difficult textbook.

If you have not been using S.Q.C., here is a real way to cut costs and have a better product.

Credit for major editorial work is due Mr. E. C. Harrington, member of the American Society for Statistical Quality Control, and Manager of Industrial Statistics, Monsanto Chemical Co., as well as to Mr. Debing and the group of authors.

The *S.P.E. Journal* is indeed proud to present this series for your use.

INTRODUCTION

Just a very few years ago the "quality control" men of industry were listening to a new theme—it ran like this, that quality cannot be inspected into a product; it must be built in.

These "quality control" men were especially interested, because that theme perhaps most accurately typified their new science—Statistical Quality Control. For many years inspection departments sought to separate the good from the bad, reject and approve, and that was about all. Even those who originated the methods of SQC hardly sought more than a better procedure for the routine function of inspection. And this they did without any question.

But along with these new methods came another contribution of greater value, a new philosophy of inspection, which was to apply control to the process by examination of the product, rather than to control the product alone. Of course, some of this has been going on for many years, but not nearly so effectively as was now possible through SQC. The logic is simple and convincing: the more adequately the manufacturing processes are controlled, the less is the likelihood of scrap and rejects. If, therefore, inspection data can be focused on the process, rather than its traditional role of sorting the good from the bad, we should have a powerful technique for maintaining the highest quality levels. In its broadest sense, this is the function of S.Q.C.

The methods by which this is accomplished will be described in a series of papers, prepared by the SPE Committee on Quality Control, to be published in succeeding issues of this Journal. The basic methods of SQC will be described including Control Charts, Process Capability studies and Specifications, Sampling Methods to assure adequate inspection, Correlation, Experimental Design and generalized Management Techniques.

The successful application of these methods requires neither highly trained nor specialized personnel. While the mathematical background of SQC is admittedly complex, the application of these methods has been reduced to simple procedures well within the ability of any reasonably alert person with high school mathematics. The routine performance of SQC, once the procedures have been set up, requires only the ability to add, subtract, multiply, and divide.

A great many manufacturers have been deterred from adopting SQC to their operations by the fear that it would increase their already considerable inspection costs. To set up sampling plans, to prepare and interpret control charts, to study process capability all require effort and time which is not now available within their working force. It is not to be expected that the initial application of SQC can be made without cost, or more likely, extra effort on the part of someone within the organization. Yet, it has been the experience of nearly everyone that within a short period, inspection costs, or alternatively,

The Use of Frequency Distribution Data In Plastics Molding . . .

Malcolm Young and John A. Kudlock
Plastics Division
Erie Resistor Corporation
Erie, Pennsylvania

At Erie, we have been using Statistical Quality Control (SQC) for six years. The more we use it, the more we like it when it is properly applied. Our engineers, inspectors and production people find it more and more useful but our customers like it best of all.

This paper on frequency distributions and variability deals with one of the simplest aspects of statistics. It is also one of the statistical tools which we had used, without basic understanding, even before we ever heard of Statistical Quality Control.

Frequency distributions are used by us in our injection molding rooms for two purposes. First, they are used to determine the average sizes and the variations in sizes we should expect from new molded parts. Second, as we do a great deal of decorating work on custom moldings, they are used to control dimensions of current production as related to the critical shielding that our finishing departments must do in order to make the high quality demanded by our own Quality Control Inspection and by our customers.

Every process has some variability. The automatic temperature controls are activated only when there is a difference between the actual and the desired temperature and so temperature fluctuations are inevitable. The preforming and preheating steps are subject to variations. In spite of extraordinary precision in die sinking, two or more presumably identical dies can never be exactly alike. Measuring out charges to a die, whether by weight or volume, introduce other sources of variability. And lot to lot, drum to drum variations in the physical and chemical properties of our raw materials are inevitable.

If you think your process doesn't vary, take fifty pieces, measure them and set down the readings. If you measure to the nearest thousandths of an inch, you will find plenty of variation in plastics. Sometimes we follow this variation by weighing pieces and plotting variations by weight instead of by length. This is easier and frequently just as sensitive as using length.

All of these sources of product variability, when reduced to their practical minimum, are lumped together and called inherent variability. This is about as good as we can hope to do without radically changing the operation.

Obviously we should not be satisfied until the observed variability is pretty close to this minimum. And here's where the "statistics" come in—for statistical theory provides a picture of what this minimum variability should be. More about this will appear in a later article on the Normal Frequency Distribution, but if your variability doesn't look pretty much like Figure 1, an approximately normal distribution, you have more variability than you should condone.

The distribution may be wider or narrower than shown in Figure 1 but it should have one peak and be fairly symmetrical. If the frequency distribution is like any of the shapes shown in Figure 2 you may be reasonably certain that your operation is not performing at its best, and that corrective action in your own shop is posible and will lead to better quality.

There are cases where the unsymmetrical, or skewed distribution (B) shown in Figure 2 is the correct and proper picture of the process but this is quite infrequent when we are dealing with dimensions.

In plant work, we do not often plot the fancy "histograms" as the above diagrams are called. It is easier to

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Introduction (continued from page 19)

scrap losses, have offset this cost many fold. If it were not so, SQC would have quietly gasped its last breath many years ago.

The period of overlapping methods may well be difficult, but it is entirely possible, and nearly always advisable, to make the transition by easy steps. A single control chart on a troublesome operation may provide a clue to its solution. It will certainly tell you how uniform your product should be under the best operating conditions and it will highlight those occasions when the conditions have not been "best". Often, it will forecast trouble before it has occurred so that corrective action will be taken before inferior materials are produced.

One hundred percent inspection is seldom one hundred percent effective. And it is almost always very expensive. Sampling plans, whose purpose is to evaluate lot quality by inspection of a small fraction of it, will most certainly save time and money in the inspection department. No one can afford to overlook its possibilities.

This series cannot possibly describe all the methods of SQC, and new ideas are developing every day, but it should provide an effective working program in the many plants which have not yet benefited by the advantages of S.Q.C.

...ion as a simple tally. An example is the following ... readings from two cavities of the same mold:

	Cavity #1 (Frequency)	Cavity #2
[illegible]		1
[illegible]		
[illegible]		
[illegible]		1
[illegible]		1111
[illegible]		111
[illegible]		11111 1111
[illegible]		11111 11111 11111 1
[illegible]		11111 11111 111
[illegible]		11111 1
[illegible]		1111
[illegible]		1
[illegible]		1
.005	1	
.004		
.003	1	
.002	111	
.001	1111	
.000	11111 111	
.001	11111 11111 1	
.002	11111 11111 11111 11111	
.003	111	
	Average — 0,0008	Average + 0,0108

Obviously the overall product is not in-control, because a histogram of the combined product would look like that shown in Figure 2 (A). This is a "bimodal" distribution since it has two peaks. When this comes to light it is the joy and delight of an SQC'er because it shows so clearly that the product quality variation is greatly in excess of what we should accept and of what the process is capable of doing. The answer for improvement should not be too difficult to find and correct.

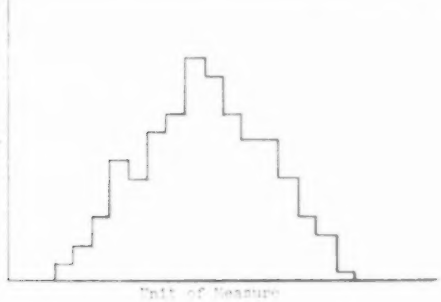


Figure 1

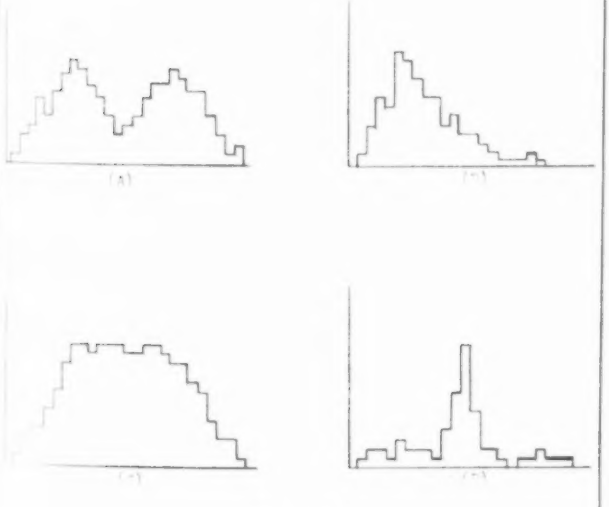


Figure 2

It is quite obvious from the above charts that painting and plating shields made for parts produced from one cavity would not fit parts from the other cavity. In this example, one of the cavities could be altered to match up with the other cavity to obtain maximum uniformity of dimension. Alternatively, and in this case the only practical solution, the product from the two cavities may be kept separate and matching shields designed for each cavity. Deviations as large as plus or minus .005 on molded parts may be successfully shielded, and it can be seen that shields designed to the average of each cavity (— 0,001 for cavity #1, + 0,011 for #2) will adequately shield nearly all of the product. The average of the frequency distribution is very easily obtained by multiplying the frequency of occurrence by the listed dimension, and dividing the sum of these products by the number of units measured. When these limits are exceeded off grade parts are being produced. How quality control charts are used to keep tabs on a process will be covered in subsequent articles.

Another interesting frequency distribution is shown for cavity #1 from a two cavity die.

+ .015	1
+ .014	
+ .013	
+ .012	
+ .011	11
+ .010	
+ .009	
+ .008	
+ .007	
+ .006	
+ .005	1111
+ .004	1111
+ .003	1
+ .002	111
+ .001	111
.000	1111
.001	11111 1111
.002	11111 1111
.003	11111 111
.004	111
.005	11111
— .006	11
.007	1
.008	

The distribution of measurements on parts from cavity #2 were very much the same except that they were at a level 0,013 below cavity #1. It was obvious that this chart more closely resembled Figure 2 (B) than the normal histogram of Figure 1 and in addition the process variability greatly exceeded the allowable ± 0,005 tolerated by the painting shields. An investigation revealed that the weigh feeder attached to the press was not functioning properly. Repair of the weigh feeder brought the process within control.

A frequency distribution illustrating a gauging error is as follows:

+ .008		.009	
+ .007		.010	
+ .006		.011	
+ .005	11	.012	
+ .004	111	.013	
+ .003	11111 11111 11111	.014	
+ .002	11111 11111 11111	.015	
+ .001	11111 1	.016	
.000	11111	.017	
.001	11	.018	
.002	1	.019	
.003		.020	
.004		.021	11
.005		.022	1111
.006		.023	
.007		.024	1
.008			

The dial indicator point, due to the construction of

(please turn to page 42)

Automatic Production

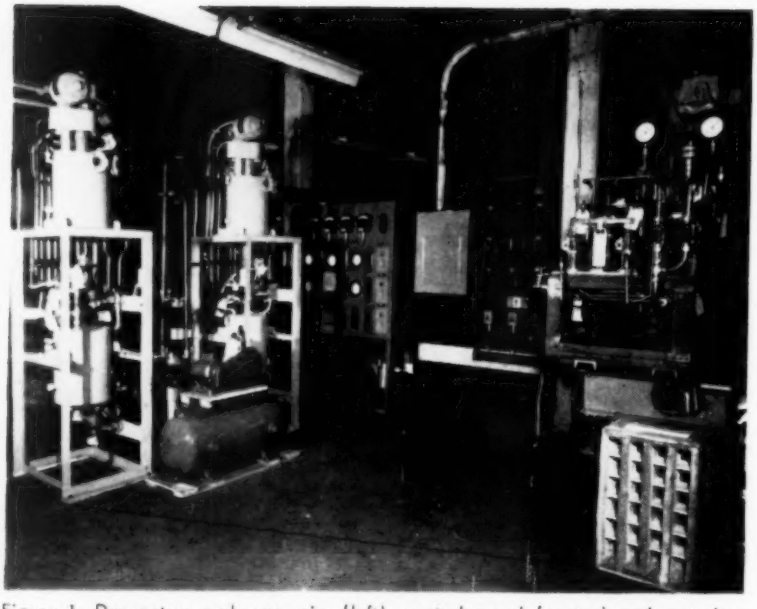


Figure 1. Deaerators and reservoirs (left), control panel (center) and metering, mixing and dispensing equipment (right) for multi-component resin mixes.

Marvin Schneider

Applied Engineering Associates
Brooklyn, New York

INTRODUCTION

THE **need for equipment** for economical continuous processing of polyesters, epoxies, liquid elastomers and other multi-component resins is becoming increasingly apparent. In recent years, the uses for polyesters, epoxies and other multi-component resins in laminating, casting and embedment, coating and adhesives have increased many-fold and are still continuing to expand. Many of the present and potential applications can progress to a larger scale only with equipment that will significantly reduce the high production costs and quality variations presently encountered with these resins.

To meet this need, Applied Engineering Associates, designers and manufacturers of plastics processing machinery, have designed and built the automatic equipment described here. The equipment continuously deaerates, proportionally meters, mixes and meter dispenses multi-component resins and elastomers. It does this under closely controlled temperatures with resins in a wide range of viscosity and pot life, including the hot melt types.

The versatility of the equipment is such that it can be used to advantage for laminating, mat molding, matched die molding; plastic tooling, adhesives and sealers; potting, casting and embedment; protective, decorative and sealant coating; thermosetting extrusion; and rigid and flexible chemically foamed plastics. In all these applications, it will cut production costs by:

1. Control of uniform quality from piece to piece.
2. Increasing the speed of processing, application and curing with a resultant decrease in floor space requirements and investment in molds and curing equipment.
3. Permitting the use of short pot life resins with a consequent saving in equipment as mentioned in item 2.
4. Permitting the use of high molecular weight hot melt resins that are lower in cost and yield improved physical properties.
5. Eliminating hand labor for transfer, weighing, mixing, dispensing and application.
6. Eliminating operator variables in batch make-up and dispensing that result in costly rejects.
7. Eliminating waste in transfer and spillage.

A basic semi-automatic model of the Applied Engineering Associates equipment is described here. This model is currently being used for electronic embedment and sealing in critical dielectric applications for miniature and sub-miniature circuits. In these applications, the cured resins must maintain their characteristics under severe humidity and temperature cycling and provide tight metal to glass seals. The ability of the equipment to handle critical applications of this type in high volume is indicative of the superior quality it can deliver in the other previously mentioned applications with multi-component resins.

For special processing needs, suitable modifications in the equipment can easily be incorporated. The materials of construction can be varied where necessary; some of the processing steps can be eliminated; and the required degree of automation can be incorporated. Its design is such that the capacity can be scaled up or down to bracket any range. The flexibility of the Applied Engineering Associates equipment makes it potentially adaptable to many applications other than strictly plastics.

Equipment for Resin Mixes . . .

—Automatic equipment for handling multi-component resin mixes on a production basis . . .

PROCESSING CONSIDERATIONS

The multi-component resins and elastomers cure by homogeneous incorporation of a separate catalyst or hardener after which they have only a limited pot life. Although they differ from each other in structure, viscosity, and ultimate properties achieved after cure, the basic methods of handling them are essentially similar. Processing for optimum properties and uniformity in the final product requires close control of deaeration, mixing, proportioning, temperature and mode of dispensing. These basic requirements are elaborated on briefly in this section.

The resin mixes must be deaerated and the volatiles removed for optimum processing and development of physical properties of the cured resins in many applications.

In many applications, accurate volume proportioning and metering can only be obtained after deaeration. Further, with polyesters, the presence of occluded air may lead to cure retardation. Aside from processing considerations, deaeration is required for the following reasons:

1. Voids or bubbles serve as focal points for concentrations of residual stresses. At these locations, mechanical and chemical deterioration begin.
2. Maximum wetting or adhesion cannot be attained without deaeration.
3. Attainment of optimum strength properties is impossible with air bubbles or voids.
4. The presence of air bubbles decreases the impermeability and ability to withstand high humidity exposure and penetration of corrosive media.
5. Optimum dielectric and optical properties cannot be achieved when air bubbles are present.
6. Deaeration is required for control of density in the cured resin.

Accurate proportioning of the mix is extremely critical in all applications for control of pot life, development of a full cure and uniformity of quality from piece to piece. The resins cure by an exothermic polymerization reaction; the rate is dependent on the concentration and activity of the catalyst. To control the maximum exotherm and obtain predictable processing properties, the ratio of catalyst to resin must be closely controlled. In addition, by appropriate variation in the resin/catalyst ratios it is possible in many applications to obtain full cures at room temperature.

Homogeneous mixing of multi-component resin mixes is required for development of optimum properties throughout the entire volume of the product. Attainment of predictable cure rates and uniform quality from piece to piece are also functions of mixing.

Adequate control of temperature of all formulation ingredients until the mixed resin is actually dispensed is required for control of the cure rate and the viscosity of the mix. With low viscosity mixes, more complete wetting can be achieved. Further, good temperature control leads to the possibility of using the cheaper high melting point resins of higher molecular weight for many applications; generally, these resins develop better strength properties than do the liquid types of lower molecular weight.

Metered dispensing is a necessity for application of uniform quantities of mixed resin in many operations. In laminating, mat molding and adhesive applications, it avoids starved areas. In embedment and potting, it maintains constant volume and coverage in the final product.

On a small scale, or in the laboratory, the attainment of the foregoing requirements may be feasible by close supervision and preparation of small batches shortly before application. However, for large scale continuous production small batch processing is unsuitable both from the point of view of product quality and cost.

Applied Engineering Associates equipment is designed for the express purpose of economically processing and applying multi-component resins and elastomers in continuous production of a large number of units. The equipment automatically performs the required processing and application functions of deaerating, accurate proportioning, homogeneous mixing and metered dispensing. It can be used for liquid and hot melt resins and elastomers such as the polyesters, epoxies, allyl types, furans, modified liquid phenolics, liquid polysulfide polymers and other liquid rubbers. It is adaptable to a large number of applications in such diversified fields as laminating; mat molding; matched die molding; plastic tooling; adhesives and sealers; potting, casting and embedment; decorative, protective and sealant coatings; thermosetting extrusion; and rigid and flexible chemically foamed plastics.

APPLICATIONS

Aside from the previously discussed benefits common to all applications, the specific advantages to be gained from the use of this equipment in various applications are described in the following sections.

WET LAY-UP

In the wet lay-up of fiber glass laminates, the Applied Engineering Associates equipment will perform the following functions:

1. Process the components at elevated temperatures to reduce viscosity, yield better penetration, and permit the use of viscous or solid resins.
2. Permit the use of short pot life materials to get quick setting or short gel times and eliminate subsequent run-off and excessive exudation or flow-out when curing under pressure, especially

with low viscosity resins. In contrast, it is often necessary with low viscosity resins of longer pot life to undertake a pre-cure period under contact pressure to eliminate flow-out.

3. Permit the use of resin/catalyst ratios that yield full cures at sufficiently low temperatures to avoid internal stresses.
4. Dispense exact quantities of resin mix to get the desired ratio of glass to resin.

DRY LAY-UP

The equipment can be used for dry lay-up techniques with solid high molecular weight resins or materials of short pot life. A potential mode of use would involve controlled melting, deaeration, proportioning, mixing, and direct metered application of controlled amounts onto the fiber glass. Presumably much of the impregnating equipment ordinarily used could then be eliminated. For pre-impregnation by roller or knife spreading, solventless resin mixes can be fed into a trough or directly onto the roll or blade.

MAT AND MATCHED DIE MOLDING

In mat and matched die molding, the equipment can be used to feed a metered amount of low viscosity resin mix of short pot life before or during molding to thoroughly impregnate the mat or preform within a short cycle.

CASTING, POTTING AND EMBEDMENT

The equipment is well suited to the high-speed application of metered quantities of resin or resin/liquid elastomer mixes for potting, embedment or casting in conveyorized operations.

MOLDING OR POTTING BY VACUUM AND PRESSURE INJECTION TECHNIQUE

The Applied Engineering Associates equipment can be used for injection or casting of multi-component resins under pressure into mold cavities after the cavities have been put under vacuum. In potting components this method results in complete flow-in of resin into the interstices of the components and complete filling of the mold. The method is also applicable to mat molding where the orientation of the fibers is such that thorough impregnation would be difficult. Injection molding of intricate shapes can also be performed by this technique.

THERMOSETTING EXTRUSION

The continuous processing features in the Applied Engineering Associates equipment lend themselves very readily to extrusion of the thermosetting multi-component resins it is designed to handle. The equipment could be coupled to various extrusion devices for the manufacture of all types of extrudable shapes.

ADHESIVES AND SEALERS

The equipment is suitable for deaerating, proportioning, mixing and metered dispensing of resin adhesives, both of the solid and liquid type. Deaeration of the mix is essential in adhesives for development of maximum strength. Metered dispensing is desirable for the attainment of a uniform glue line.

DECORATIVE, PROTECTIVE AND SEALANT COATINGS

Relatively thick coatings of epoxy or polyester resins that will cure quickly can be applied from a solventless system by means of this equipment. The Applied Engineering Associates equipment could be coupled to spray guns or rollers for application of thick coatings in one operation. With this system, the hot melt resins of high molecular weight can also be used.

By selection of suitable resins and catalyst ratios, the formulations can be heat triggered to cure upon application, thus eliminating the need for bake ovens.

FLEXIBLE AND RIGID CHEMICALLY FOAMED PLASTICS

The equipment is well suited to the continuous and intermittent production of foamed resins of the rigid and flexible types. Critical process variables such as accurate proportioning of ingredients, temperature, viscosity and maintenance of uniform pot life are controlled within narrow limits. Maintenance of uniform pot life throughout the entire mass of a foamed shape is required to obtain uniform density throughout a foamed article particularly in larger shapes. The other variables are important if batch-to-batch uniformity and predictable properties are to be maintained.

In the continuous production of foamed polyisocyanates from polyesters and isocyanates, the equipment accurately proportions the ratios of prepolymer and catalyst into the mixer. The components are mixed rapidly and homogeneously and meter-dispensed continuously with a uniform pot life.

With extremely reactive prepolymers, processing involves the proportioning of all ingredients directly into the mixer.

Foamed epoxies are prepared by metering all components directly into the mixer and meter dispensing from there.

DESCRIPTION OF AEA EQUIPMENT

GENERAL DESCRIPTION

To fulfill the processing and application requirements in the continuous production of multi-component resins and elastomers, the material flow in the Applied Engineering Associates equipment is so arranged that the formulation ingredients move through the following stages in the sequence indicated:

1. Deaeration
2. Storage
3. Proportioning
4. Mixing
5. Dispensing

(If occluded gases in the mix components do not critically affect proportioning and/or the desired characteristics of the end-product, the equipment provided for deaeration can be eliminated.)

These operations are performed automatically at a rate determined by the demand once the machine is started up. All materials are propelled through the system by pressure applied at the reservoirs. The equipment is jacketed throughout to maintain the mix components at a controlled temperature. Adequate instrumentation to control the variables and to indicate the need for adjustments is provided.

Pressures of 5 to 150 p.s.i., depending on viscosity, are used for transmission of materials through the system. A source capable of furnishing about 30 inches of vacuum is required for deaeration and to aid in materials transfer. The system could handle materials in a temperature range of 10° to 350° F., depending on requirements.

A schematic flow diagram of the equipment and controls is shown in Figure 2 to explain generally the operation of the equipment. The processing units in the equipment are coordinated with one another by instrumentation to maintain the output at the same rate as that of withdrawal from the mixer. The mix components at the desired temperature are drawn by differential pressure into the deaerating chambers. After deaeration, they are transferred into their respective reservoirs by application of pressure in the deaerators and vacuum in the reservoirs. From the reservoirs, the materials are transferred by pressure through four-way valves into the mixer. Metering of accurate quantities through the valves is

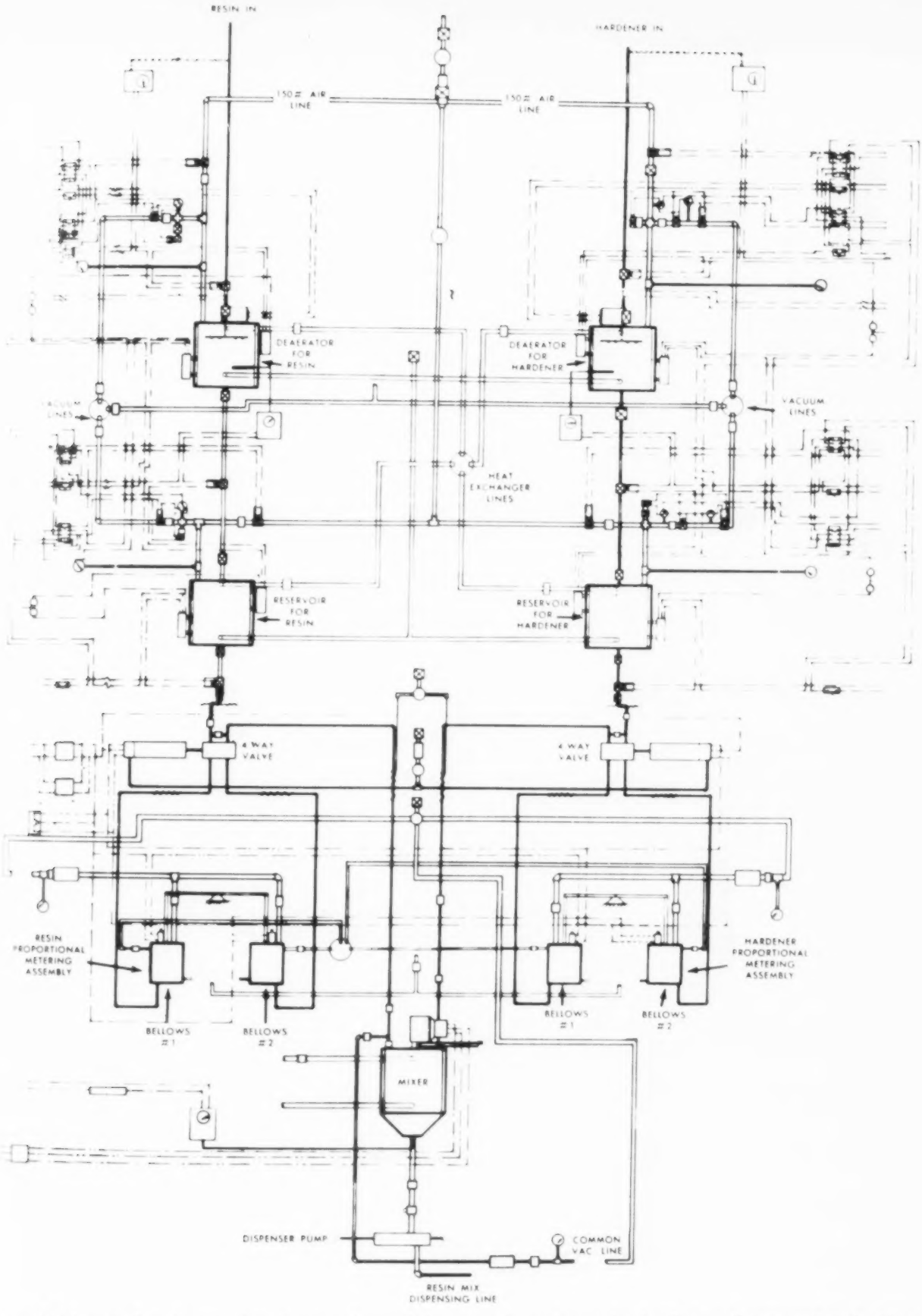


Figure 2. Schematic flow diagram of equipment and controls for automatic equipment for handling multi-component resin mixes.

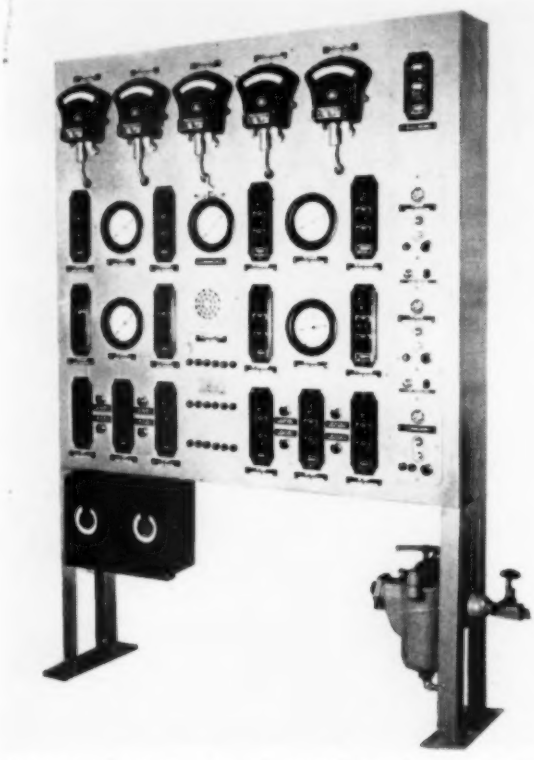


Figure 3. Close-up view of control panel for automatic equipment.

controlled by double-acting bellows systems. From the mixer, the mixed components flow under pressure to a dispensing nozzle or a reciprocating metering pump which dispenses at an adjustable pre-set rate.

The equipment set up in a conveyorized installation is shown in Figure 1. In the left foreground the deaerators and reservoirs can be seen. The proportional metering, mixing and dispensing units are in the right foreground. In the background the control panel is shown. In this particular installation the equipment is being used to dispense 0.13 c.c. volumes of an epoxy resin mix at the rate of 50 charges per minute. A metal to glass seal that withstands severe humidity and temperature cycling is obtained.

A close-up view of the control panel is shown in Figure 3. The important variables in the operations are indicated and controlled from this panel. The following control and indicating units are incorporated in the panel:

a. Indicating controllers for temperature of material entering and leaving the deaerators, and leaving the mixer. The latter unit is connected to an alarm bell to provide audible warning to the operator.
b. Vacuum gauges to indicate vacuum in the deaerators for deaeration and in the reservoirs for materials transfer.
c. Pressure gauge for indicating air pressure to reservoirs and deaerators for materials transfer and pressurizing the system.
d. Signal lights to indicate high and low levels in the reservoirs and deaerators.
e. Manual push button switches for vacuumizing the deaerators and reservoirs, positioning the four-way valves operating the interlocked solenoids to accomplish materials transfer; and for the deaerator centrifugal plate heaters to which the temperatures are pre-set.
f. Motor starters for the deaerator and mixer motors.

DEAERATION AND REMOVAL OF VOLATILE COMPONENTS

Efficient deaeration of the resin and hardener is accomplished by exerting a vacuum on a thin film of each component in its respective deaeration chamber. The deaeration chambers are jacketed vacuum vessels, each fitted with a shaft driven rotating disc. Depending on the requirements, a heating element for control of film temperature is incorporated in the disc.

Resin is transferred from the resin supply to the deaerator by differential pressure. The resin or hardener is dropped onto the rotating plate near its center and spreads to a thin film over the entire plate by centrifugal force. During the centrifugal spreading, the material is deaerated. Moisture and other volatile impurities are also removed at this time. The material drops off the edge of the plate into the lower portion of the chamber where agitation assists further deaeration. When the material in the lower part of the deaerator reaches a predetermined level, the feed is shut off by a level control and a light goes on at the control panel. The deaerated material is then transferred by pressure into the reservoirs.

Controls for the following variables are built into the deaeration process; the control elements are connected to the central panel board to enable the operator to determine at a glance whether the variables are within predetermined limits:

1. Material temperature
2. Temperature of deaerated material
3. Vacuum for deaeration
4. Pressure for materials transfer to reservoir
5. Upper level of deaerated material
6. Lower level of deaerated material

Compared to the deaeration process in the Applied Engineering Associates equipment, the usual batch method of deaerating by exerting a vacuum at the surface of a volume of material is inefficient and time consuming. All entrapped gases beneath the surface must first expand and find their way through the height of material.

By drawing a vacuum on a very thin film of material as in the Applied Engineering Associates deaerator, the efficiency and speed of the process is greatly improved. A very important processing consideration that necessitates an efficient system is the adverse effect of entrapped air or volatiles on accurate metering of the final mix. The amount of entrapped air and volatiles may vary in each component in the formulation. Under such conditions, inaccurate proportioning and batch to batch variation in the final volume of the cured material may result from inefficient deaeration. With the Applied Engineering Associates equipment, the extent of deaeration is such as to remove these handicaps.

WORKING RESERVOIRS FOR DEAERATED MATERIALS

The deaerated materials are stored in jacketed reservoirs at controlled temperatures. Material is transferred automatically to the reservoirs by means of pressure exerted in the deaerators and vacuum drawn in the reservoirs. Transfer begins only after (a) suitable pressure is built up in the deaerator, (b) suitable vacuum exists in the reservoir, (c) the deaerated material is at the required temperature, (d) the reservoir material is below the high level and (e) the deaerator material is above low level. Transfer stops when the reservoir high level

...erator low level is reached. Pressure is used to ... the material from the reservoir into the rest of the system.

Controls for the following variables are incorporated in the reservoirs:

1. Vacuum to aid in materials transfer from the deaerators and to prevent entrapment of air.
2. Pressure to transfer materials into the metering system.
3. Upper level of material.
4. Lower level of material.

As with all critical variables in the equipment, the sensing element for each control is connected to the panel board to show whether the variables are within control limits.

PROPORTIONAL METERING ASSEMBLY

Accurate proportions of the components entering into the final mix are metered into the mixer by precise volumetric measuring units based on double-acting opposed bellows for metering control. A separate bellows system is used for each component to be metered into the mixer.

The metering control unit consists of two bellows, each in its own jacketed cylinder. One end of each bellows is sealed and fastened to the cylinder. The other end is free to move within the cylinder and is linked to a common beam to which the corresponding free end of the other bellows is also connected. Each unit is connected to its own material reservoir and to the mixer through a four-way valve.

When hydraulic pressure of the material being metered is exerted in one cylinder in the bellows unit, the bellows in that cylinder contracts and is depressed, causing the coupled bellows in the other cylinder to rise or expand, and to exert a surge of equivalent pressure on the material in the four-way valve. The operation of the four-way valve is coordinated with the bellows system by means of a solenoid air valve that controls the opening and closing of the valves. On each contraction stroke of one of the bellows, the line between that bellows and the reservoir is open, whereas on each expansion stroke, the line between the bellows and the mixer is open. In this way, each bellows is alternately connected to the reservoir and mixer. Since there are two bellows in each metering unit, continuous flow of metered material is assured.

The bellows units for each component are coordinated by relays with one another. This coordination insures proportional metering of every component in the formulation. The possibility of "out-of-phase" pumping of the formulation ingredients is limited by this arrangement.

The possibility of "setting-up" in the mixer is avoided since materials can be metered into the mixer only at the same rate as the mix is withdrawn; only the draw-off at the mixer with the resultant pressure drop permits the inlet of fresh material. The relative proportions of the materials in the final mix can easily be varied by adjustment of the length of stroke of each bellows. Stroke length is accurately controlled by limit switches on adjustable stops.

The following variables in the bellows metering system are controllable:

1. Limit stops on bellows.
2. Phase coordination of all bellows systems feeding simultaneously into mixer.

The design of the bellows metering system is so unique that its advantages merit enumeration:

1. Since pressure on the material to be metered moves it through the bellows system, driving motors, pumps and attendant controls are eliminated. Response to a drop in pressure in the mixer created by withdrawal of mixed material is instantaneous and only the amount withdrawn from the mixer is always replenished.
2. The unit is of simple construction, does not use seals, piston rings, spring-loaded check valves, or rotating parts. Consequently, it is easy to clean, is not subject to wear and sticking or erratic action and requires very little maintenance. Its construction eliminates the possibility of leakage or seepage of air into the system. Almost any type of material of construction can be used to meet special requirements.
3. The unit is relatively small for the quantities it handles and can meter materials accurately in a wide range of viscosities. There is no lower limit to the amounts or proportions of materials that can be metered.

MIXING

Homogeneous mixing of all the components in the formulation is accomplished in a jacketed chamber by alternate agitation and forced passage of the materials through a series of diffusion plates containing a large number of holes. The interior of the mixer is smoothly

POT-LIFE AND REPLENISHMENT CURVES FOR TYPICAL RESINS

Figure 4.

POT LIFE AND REPLENISHMENT CURVES FOR A TYPICAL POLYESTER RESIN AT 65°F. CONSTANT

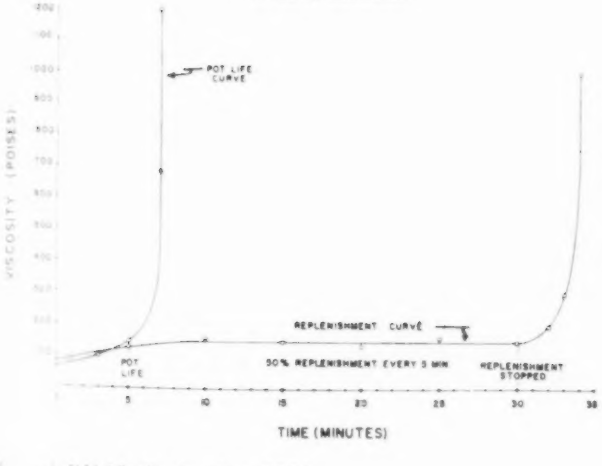
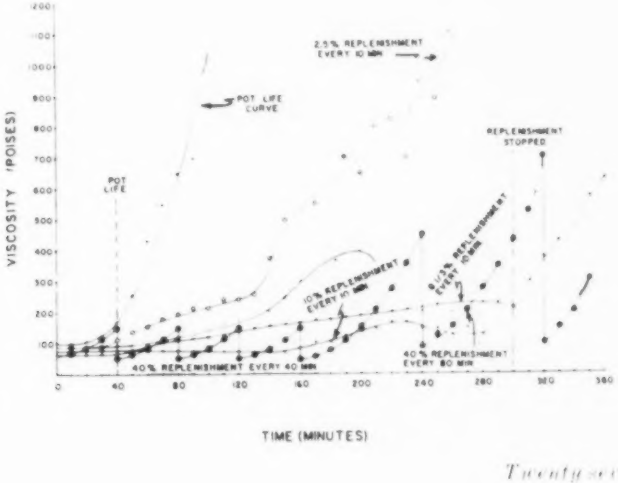


Figure 5.

POT LIFE AND REPLENISHMENT CURVES FOR A TYPICAL EPOXY RESIN AT 65° F. CONSTANT



machined without abrupt changes in cross section to eliminate areas of stagnation. The impellers are driven by a common vertical shaft and are spaced alternately between the plates.

The material passing through the holes in the plates is broken into streams, re-agitated and forced through another plate. By repetition of this process through a series of impellers and plates, the material is rendered homogeneous by the time it reaches the bottom of the mixing chamber. After reaching the bottom, the material that is not drawn off immediately by the dispenser is recirculated through the mixer and mixed with fresh material to extend the pot life.

The mixing chamber is sized to insure sufficient replenishment with fresh material to maintain pot life. In this way, the pot life of the mix is continually extended.

The effect of continual replenishment on the pot life of polyester and epoxy resins at constant temperature, is plotted in Figures 4 and 5. The graphs indicate that the principal difference in the viscosity curve between epoxy and polyester resins is that the polyester, after mixing with the catalyst, has a slow induction period of limited change in viscosity, followed by a sudden rise in viscosity to gelation in a very short time. The viscosity of the epoxy, on the other hand, rises gradually until gelation occurs.

As indicated in Figure 4, in a polyester with a batch pot life of 8 minutes, 50% replenishment every 5 minutes with fresh components extends the pot life indefinitely and maintains the viscosity at a constant level only slightly higher than initially. With the cessation of replenishment, the viscosity curve is similar to that obtained in batch mixing. The effect of varying degrees of replenishment on epoxy resin mixes at different time intervals is shown in Figure 5. By increasing the percentage of replenishment at constant time intervals, a tendency towards maintenance of the initial viscosity level results.

To determine replenishment requirements with various resin mixes, the replenishment factor is determined by empirical evaluation of the batch pot life of the resin mix. The calculations then involve the employment of a constant that has been found to be useful in most cases, namely, 50% replenishment in the batch pot life time. To approximate the initial viscosity and maintain it at a constant level, the addition of small increments at greater frequency corresponding to the estimated replenishment rate is required.

As a safety feature, if the dispensing rate is less than the lower design limit, sufficient material is purged from the mixer automatically. This is assured by means of flow and pot life timing mechanisms. The cycles on both timers are set at predetermined limits and the flow time begins accumulating time on start-up. When mixed material is not being consumed, time is accumulated on the pot life timer. If the pot life timer reaches the end of its cycle before the flow timer, an outlet solenoid valve opens and the mixer is purged until the end of the flow timer cycle is reached.

The variables controlled in the mixing operations by instrumentation are as follows:

1. Material supply pressure
2. Temperature control of mix
3. Purge control for pot life extension
4. Rotation of mixer impeller

Homogeneous mixing of resin mixes on a batch scale is complicated by the variation in the viscosities of the components and the high viscosities frequently encountered. Normally, vigorous shearing action is required to attain homogeneity. In an open system, mixing is further complicated by the inclusion of air.

The mixing process in the Applied Engineering Associates equipment does not suffer from these deficiencies. First, mixing is performed in a closed system from which air is excluded. Second, ample shearing occurs in the passage of the components through the series of diffuser plates.

DISPENSING

Accurate quantities of mixed resin are dispensed by means of a reciprocating metering pump. This equipment contains a reciprocating displacement piston and a reciprocating valve piston in a fixed cylinder. Each piston moves toward the center of the cylinder, alternately expanding and contracting the cavity between their faces. On the expansion cycle, an intake port is opened, and the mixed resin flows in under pressure from the mixer; on the contraction stroke, an outlet port is opened and a metered volume of material is dispensed.

The amount of material metered by the dispenser on each stroke may be varied by changing the stroke of the dispenser piston and by varying the size of the inlet and outlet ports.

OPERATION OF AEA EQUIPMENT

Once the equipment has been set up and placed in use, only one operator is required for the entire process including dispensing and application.

The controls incorporated in the equipment are designed to prevent extensive shutdowns or losses through operator errors, once production has begun. For example deaeration of the starting ingredients cannot proceed at the same time material is being transferred to the working reservoirs. During transfer of materials to the reservoirs all operations cease automatically. After an extended shutdown, in which the lines are filled with liquid resin alone, a simple procedure initiates normal operations.

INITIAL START-UP AFTER DISASSEMBLY

The start-up procedure after disassembly is relatively simple. After deaeration of the components and transfer to their respective reservoirs, an operation that consumes several minutes only, the proportional metering systems are evacuated and filled with the mix components. The procedure is such that the mixer is also evacuated to fill it with the proportioned materials and then operations are started.

DAILY START-UP

At shutdown, the catalyzed resin mix in the mixer is discarded and the mixer is purged and filled with uncatalyzed resin. At the start of the day's work, the reservoirs contain a day's supply of deaerated component. Before operations can be initiated, a proportional amount of catalyst must be added to the mixer. The residual unmixed resin from the dispenser line must also be removed and replaced with the mixed resin.

DAILY SHUTDOWN

To shut down the equipment at the end of daily operations, the hardener or catalyst content in the mixer and dispenser must be reduced to avoid "setting-up" of the resin. This is accomplished by filling the mixer and dispenser systems with resin directly from the reservoir. A typical purge procedure involves the discard of one mixer volume of the resin mix. Subsequently, four to five mixer volumes of straight resin are transferred through the mixer and dispenser systems and salvaged. With this procedure danger of "setting-up" in the lines is avoided.

Applied Engineering Associates has applied for a patent on the equipment described in this article. No statement herein should be construed as an offer to grant a present or a future license.

PLATING *Racketeers* Invade The Plastics Industry

Arthur W. Logozzo

Nutmeg Chrome Corp.

Every legitimate field is invaded by sharpies or fake promotion experts every so often. The field of hard chrome plating of plastic molds has been the target of a group of characters for the past two years that would put to shame any previous illegitimate attempts in any field of endeavor. These characters dress like the street corner wolf, look like they just got off the last boat from some remote shore, and act like they should be booking on the four-legged plater instead of plying the trade of the two-legged hard chrome plater.

The address used by these fakers has been traced to vacant lots, empty gas stations and non-existent streets. We have seen rubber stamped calling cards handed out by various members of the gang, each with a different name and address and in a different city or town. We know of one engineer in a large plant who made a hobby of collecting these cards until even his cast-iron stomach revolted at the continued sight of this crew.

Method of Operation.

The methods used to gain entrance to legitimate plants are something that should arouse suspicion and result in a closed door policy. Unfortunately, they are continuing to get into many places.

Their entree is usually a gimmick involving a trick name with its selling point being that the surface is harder and longer wearing than hard chrome with no thickness limitation. They try to get a sample mold, insisting that is the only way of testing their material. This mold is then taken to a plater and he is asked to plate it for them. They tell the plater their line is lining tanks with a corrosion proof metal spray, but this customer would like them to handle a few molds for them. The plater, being a little stupid as well as philanthropic, plates the mold to help out the guy. If the zoot-suited faker is unable to enlist a plater's help he unceremoniously puts a little polish on the mold and after a suitable waiting period returns the mold or part and insists on payment. Because of the potential lifetime service the user can expect, even though the part may not have been plated, the parasite demands a high fee for the special service. The sad part of it is many people are giving checks because they don't know quite how to handle the situation. Some cases have been reported where both purchase order and packing slip called for a "No Charge" treatment. In these cases the characters get indignant, use profane language, and their true nature shows up immediately.

We know of one large concern that had ten thousand dollars worth of special blanking dies entrusted to these fakers that were ruined. An examination of these parts revealed no surface treatment other than a hard buffing operation that ruined all important edges. We were called by the technical director of this company and as soon as he mentioned one of the trick names we asked if he had tried to contact the culprits and he replied affirmatively. I asked: "Did you find an empty lot or non-existent address?" He had!

The office for these fellows is usually the trunk of a car. Occasionally it is the temporary home quarters of one of their lot, as is evident by the babble of babies' voices in the background when the phone is answered.

These peddlers of woe for the platers' industry usually travel in groups of three or more. The type wares they sell demands a crowd for protection. We have heard where they would get nasty with the receptionist when she informed them no one was available. In cases where the receptionist saw them for the first time and gave them the usual pleasant reaction they have made offers to plate desk fixtures, bracelets, etc. They also utilize a follow-up system by getting a prospect's home address and bringing a gift item with an inexpensive silver plate.

One case recently called to our attention involved this group selling their wares to the chief engineer. He called the tool man and asked if he had any molds ready for plating. The tool boss said no but he just got a load back from his regular source. The engineer suggested he bring one of the complicated segments up and he would have these new boys strip and redo with their new process. The tool boss then put a small mark in a not too accessible spot and gave the part to the engineer who turned it over to the "boys" for the new, permanent, harder than chrome treatment to be done on a sample basis. After ten days the characters returned with the part and asked for $160.00 because of the intricate design. The engineer mentioned the sample basis but they sold him on how lucky he was and he procured a check. Feeling very proud of himself he turned the part over to the tool boss who looked for the red crayon mark, found it and showed it to the nonplussed engineer. In short, the piece had not been touched but merely held in escrow for ten days. Needless to say, the "boys" had made a hurried exit. To where?—the next gullible engineer. They got $160.00 for doing nothing and were paid immediately. We got $12.00 for the original plating.

Anytime you think the gimmick used for hard chrome is rank, you should ask for the "piece de resistance", the permanent coating used for tanks, accumulators, etc. One report involved the material washing off the first time an aqueous solution was passed through it and the coating clogged an intricate, expensive sump arrangement. The guy that was duped seems to have developed a propensity for nightmares, waking up in the middle of the

night hitting these fakers over the heads with his fouled up tank. We wish the nightmare were a reality.

Another report involved circumventing the engineer responsible for the accumulator tanks, who had turned down their offer of coating the tanks at so much per square inch (which would have exceeded the cost of a new tank) and telling the press room foreman to plan on a shutdown because they were given the job of corrosion-proofing the tanks. The foreman, suspicious, checked back to the main plant and found it to be a hoax so did not cooperate. The "boys" wound up gaining access to plant manager's office and preferred charges against the engineer—charges of impeding progress. The plant manager correlated the facts and had the "boys" ejected. Much to their chagrin they were denied access to this plant again but nevertheless tried.

Another plant manager, by this time aware of the gang and their methods, called to say they were in his reception room and what was the best way to handle them. We suggested making a date with them to inspect their facilities, which he instructed an engineer to do. The "boys" excused themselves and did not reappear when this request was made of them.

Incidentally, this tank anti-corrosion scheme is used by the gang to open the door to various plating shops. They come in looking for a sample job on a part and then discuss the possibility of coating the plater's tanks in return for plating a few samples. These same samples of course are the ones they bring back to the prospect and ask for an exorbitant sum.

Conclusion and Recommendations.

Due to the similarity of names, systems used, attire and methods of approach, it is very evident that this is an organized gang. Their operations are far-flung and many areas are honored by their presence simultaneously. Some people have expressed a desire to see them jailed but how to go about it without getting involved in a countersuit of some sort is the big problem.

For obvious reasons we cannot give names, etc. Their photos would resemble a Capone-era rogues' gallery and unfortunately these cannot be shown.

Some definite recommendations for combatting this gang and their methods are as follows:

1. A full technical explanation of the process should be demanded.
2. Insist on inspecting their facilities before giving out any work.
3. If you prefer giving any samples at their request, make them sign a "No Charge" packing slip.
4. If they get nasty with the receptionist or any member of your firm not cooperating with them, call the plant or local constabulary immediately.

The above is written only after many requests were made by reputable business people in both the Plastics and Plating Industries. It is intended to serve as a warning to those who have not had the honor of a call and acquaint them with some of the methods of this new form of racketeers. This is not intended to be misdirected at any of the many reputable people introducing new products or processes in the plating or plastics industries who have open house for examination of their facilities at all times. In fact, we are just as desirous of seeing new hard chrome developments to further our position in these industries as anyone else. Let me reiterate, this is aimed at the vicious fly-by-night hit-'em-once operators herein described.

Plastics Scrap

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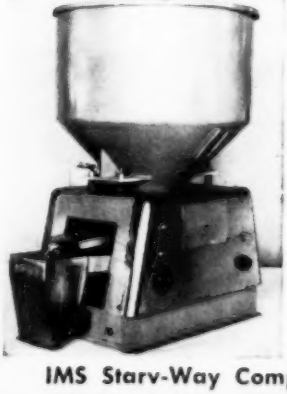

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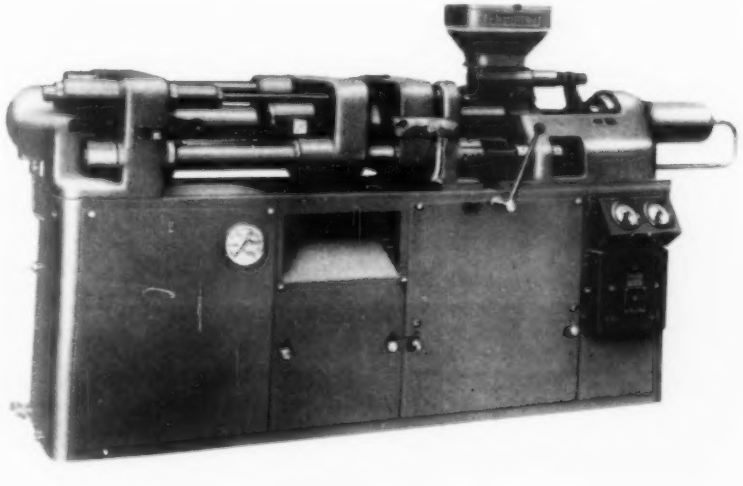
"It is the freedom to disagree, to quarrel with authority, in intellectual matters to think otherwise, that has made this nation what it is today." Dr. James B. Conant

INJECTION MOLDING IN EUROPE

This summer I visited several injection molding concerns and injection molding equipment manufacturers in Europe. Foreign molders are good craftsmen, but they don't go in for volume production the way we do. The market for large moldings there does not compare to this country, and the bulk of their products are in the 8 oz. and under class. Some of the troubles with molding powders now being made in Europe are similar to troubles we used to have before batch and quality control reached its present state of perfection: uneven flow, variable heat stability, variable shrinkage, etc. The equipment makers are in a different category than American concerns because both labor and materials are comparatively cheap. With a little American know-how in machine design, you could build a press in Europe and set down duty paid in New York for less than you could make it here. The big problem would be to get and use standard timers, pumps, limit switches, and other components that would be either identical with ours or readily replaced by ours in event of trouble. It's the repair and maintenance angle that keeps the flood of cheaper European presses out, I believe, not price or other factors. Some of the neatest jobs in Europe are the A. Truilzi 4 and 8 ounce presses. Made in Milan, Italy with chrome plated tie bars, and water operated from a central system, they have press speeds such as are optimistically described in many manufacturers' brochures, and these are production speeds, not dry cycles either. It's quite a sight to see just how simple a press can be when it is hooked to a central system—clean, neat, compact—no clutter of pipes, valves and hydraulics.

My general impression of European plastics, however, is a negative one. They are hungry for our know-how, but not hungry for our equipment; as if they have the know-how, they can duplicate our products for a fraction of our price. But then don't forget, any technical or cost edge they have on us is immediately tied into the social system. There is no middle class to speak of in Europe. There are a few very rich, many very poor, and almost none who fall in the category we call middle class that makes America what it is today. Then too, the vagaries of exchange are tricky indeed, and dollars are hard to pry loose, so all in all, the cost of doing business with Europe is higher than doing business at home. I came away with the feeling that the export picture is a dubious one at best.



A Truilzi two-ounce machine, manufactured in Milan, Italy, for operation by water from a central hydraulic system.

Meeting Notices

Milwaukee

Our September meeting will be held on the 9th, starting at 6:30 P.M. It will deviate from our usual format by being held in the Miller Inn, adjacent to the Miller Brewing Company. The meeting will consist of a tour of the Miller Brewery and a complimentary buffet supper given by the Miller Brewing Company. If time permits, we will also hold our annual election of officers. If the scheduled tour takes longer than planned, our election of officers will be postponed until the October meeting.

South Texas

September 15th, Mr. Z. Crocker, Bakelite Company, will discuss vinyl film sheeting with particular emphasis on the plasticized film sheeting such as is associated with inflatables and swimming pools. Mr. Crocker has been with the Bakelite Company approximately two years, all of that time having been devoted to either plant work or sales work for the vinyl film sheeting material.

Mr. F. W. Wurtzell will cover the extrusion of both elastomeric and rigid vinyl materials for pipe, garden hose and wire coating. Mr. Wurtzell has been with the Bakelite Company for ten years, concentrating all of that time on the extrusion activities with half of the ten years spent in the laboratories and the second half in direct sales work.

Mr. Harold A. Holz will cover the subject of injection molding of elastomeric vinyls with particular emphasis on new gating principles.

Western New England

Date: September 8, 1954—Dinner 7:00 p.m.

Place: Bradley Field—Terrace Dining Room.

Technical Chairman: Tom Mallory.

Kickoff Speaker: National President—John LaBelle, Foster Grant Co., Inc., Leominster, Mass.

Topic: "A Precipitous Curve."

John will start off our new season with a good talk on the present and future of plastics, as well as the latest on S.P.E. educational policies.

Second Speaker: Wilfred Lynch, Moxness Tool Works, Racine, Wis.

Topic: "Canadian and American Molding Practices."

Wilf is the most qualified person in the S.P.E. to talk on this subject. He has spent considerable time in preparing this topic and with his background should round out a most auspicious opening meeting.

Buffalo

Meeting Date: September 17th.

Place: Park Lane Restaurant.

Speaker: Mr. William V. Bergren Supervisor, Time & Motion Study The Carborundum Company.

Subject: "Methods Improvement Techniques Can Save You Money."

AROUND THE WORLD

AUSTRALIA

AUSTRALIAN PLASTICS

Vol. 10, No. 102, January, 1954

Abstracter: Albert Lightbody

A SYMPOSIUM ON VINYL COMPOUNDING, PART I

The edited condensation of a symposium sponsored by the Akron Rubber Group and the Cleveland Akron Section of SPE gives the answers to many questions on mixing, molding, compounding and extrusion of the vinyl plastics.

TRICKS OF THE TRADE

A new feature of "Australian Plastics" lists (1) a design of screw lid for bottle to improve ease of manufacture; (2) insulating grates instead of continuous sheets for heat insulation in hydraulic presses; (3) wetting of contact surfaces with plasticizer before welding to improve strength in welded PVC foils; and (4) flame spraying of plastics to prevent corrosion of steel.

PLASTICS IN THE TROPICS

These results of tests conducted by the British Ministry of Supply—British Plastics Federation panel on polyethylene show that exposure to sunlight for more than six months was quite deleterious. There was an increase in brittleness, loss of extensibility, and the appearance of surface cracks. Carbon black (0.1%) in the polyethylene provides a considerable measure of protection against deterioration due to light. There were no indications that fungal growths had attacked the polyethylene. A general progressive shrinkage and loss of weight occurred at all sites.

PLASTICS IN RADIO AND TELEVISION, F. C. Pullen and B. E. Terry

In this review of plastics as used in the television industry, the authors deal with some of the problems that are presented in the manufacture of plastic television cabinets, describe a new "fast cure" powder and dilate upon some of the more interesting electrical moldings used in television sets. Some of the principal plastic materials used for television components are also described.

CANADA

CANADIAN PLASTICS

June, 1954

Abstracter: Harriman H. Dash

PLASTICS INTELLIGENCE, pp. 31-40 and 114-119

News and cues of personalities and companies of the Canadian Plastics Industry.

WHAT'S NEW IN PLASTICS, pp. 43-49

Pictorial Review of new items in production.

HIGHLIGHTS OF 12TH ANNUAL CONFERENCE (SPI Canada), **D. M. Taylor,** pp. 51-70

Mr. Taylor reports on the attendance and papers read at the 12th Conference (April 5-6, 1954, Montreal). R. B. MacPherson (Can. Ind. Ltd.) spoke on business forecasts. B. Werne (SPI Consultant) discussed union contracts, and A. H. Cole (Can. Car & Foundry) outlined a program for plant safety. D. C. R. Miller (Dow Corning) described the uses of silicones. J. E. Carey (Shell Chemical) reported on the expanding applications of epoxy resin, particularly in the reinforced plastics field. J. Johnson (Chicago Molded Products) presented a paper on problems and cost of large section moldings. D. Wilson (Polyrein Corp.) reviewed developments in reinforced plastics and pointed to the need of better engineering background to solve the many production problems arising in the field. Other speakers included J. Scholkin (Beacon Plastics) on informative labeling and D. W. Buchanan (Secy. Ind. Design Council) on design work.

The delegates, among whom the Dominion Government Departments were well represented, were welcomed by Montreal Mayor Camilien Houde. William Cruse (Exec. VP, SPI) recapitulated the progress in SPI and introduced for adoption the Statement of Principles previously accepted by the industry in the U.S. G. Murray Scott (Dow Chemical) delivered the presidential address which closed on a note of optimism.

A digest is presented of the conference papers of Messrs Scott, MacPherson, and Scholkin.

Winners of the 1st and 2nd Achievement Awards presented by Canadian Plastics are listed. Officers elected for 1954-5 are:

Pres., G. Murray Scott (Dow Chemical); Vice-Pres., Alfred E. Byrne (GE); Treas., Robert Todd (Irvington Varnish); Director, Frank Rice (Canadian Industries).

PRODUCTS IN BRIEF, pp. 70-75

Polyethylene Pipe—4" ID pipe has been produced by Pacific Plastics for the Government of British Columbia in conformance with Standards 42-GP-5. Plans for 6" ID pipes are under way. Vancouver Plastics is designing a special extruder for the large size.

TV Mask—Reflector housings for Sylvania's Halolight masks framing the TV picture tube are produced from Campco s-300 by Courtland Industries. The mask and housing form a dust free enclosure for a neon bulb which rings the picture tube. The soft glow around the picture eases eye strain.

Projector—Redesigned by Bersudsky And Associates to cut costs, the Magnojector (Austin Mfg. Co.), a reflex type projector, can be assembled in 60 seconds. Ventillating fins, handle, and positioning bosses were made part of the housing which consists of warp-free phenolic molded halves cemented together during assembly.

Anti-Static Shield and Coil Form—Tooled by Marsland Engineering and produced by Canadian GE for the Dep't. of National Defense, these items won top honors in the Canadian Plastics Achievement Awards. The shield is a composite of copper and cotton fabrics impregnated with polyester. The coil form was injection molded to close tolerances from Nylon FM 10001 .

PACKAGING REVIEW, pp. 78-84

Highlights of the National Exposition, April 5-8, 1954, Atlantic City. Comments on exhibitors are presented alphabetically.

TECHNICAL DEPARTMENT, pp. 89-92

EMULSION POLYMERIZATION PROCESS, W. W. Crouch and J. E. Wickham

(Summary of paper presented at the ... National Meeting, Am. Chem. ... Kansas City.)

This summary discusses the production of Polysulfone Resins from oil-refinery by-products by means of an emulsion polymerization process. The polymers so formed can be used in extrusion or coating applications. The resin properties are improved by blending with other plastics (nylon, rubber, acrylate). Engineering Filing Systems Simplified—This paper discusses the advantages of adopting a basic classification system, such as that used by Sweet's Catalog Service.

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FRANCE

INDUSTRIE DES PLASTIQUES MODERNES

Vol. 6, No. 5, May, 1954

Abstracter: Hans Mayer

THE FRENCH INDUSTRY BUILDS UP—The new factory of the Solvic Company at Tavaux.

The equipment and manufacturing methods of this new factory which can produce 4000 tons of polyvinyls for all known applications are described.

THE FITTING OF SEMI-RIGID POLYETHYLENE PIPING, M. Delattre

The problems in piping and plumbing with polyethylene tubing and fittings, caused by the thermo-plastic nature of the material, are being discussed and proper methods as used in the U.S.A. and in France are being enumerated.

POLYSTYRENE WALL TILES, A. Scrivener

This article tries to promote the use of this type of wall covering by describing the mounting methods used in the U.S.A. It also points out that the use of this article which accounted for the molding of 17,000 tons of polystyrene in 1953 in the U.S.A., depends largely on the "do it yourself" trend.

THE EVOLUTION OF THE PLASTIC CAR BODY (continued), J. Rappeneau

Methods and conveyor assembly of the French plastic reinforced car body are further described. Temperature regulation on plastic processing machines. Tooling and wiring arrangements for optimum heat control are described.

CONSIDERATIONS ON HEAT RESISTANCE TESTS, Barat, Condette, Valayer

The authors try to describe test methods and arrange for a system to evaluate results, obtained under the different methods, in such a way that a comparative evaluation becomes possible.

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GERMANY

KUNSTSTOFFE

Vol. 44, No. 4, April, 1954

Abstracter: Anne Schwend

PROPERTIES OF SILICONE RUBBER, Dr. M. Wick and Wolf Dietz

More than a year ago the Wacker-Chemie GmbH of Muenchen introduced German-made silicone caoutchouc on the market. Due to the wide range of application this silastic material enjoys good demand. Simultaneously with the announcement of a reduction in price, this paper discusses the mechanical and chemical properties of silicone caoutchouc. The electrical properties at elevated temperatures and after ageing are investigated, but will be considered in more detail in a later article which shall also deal with processing methods and the forms of application.

GLASS FIBRE REINFORCEMENTS FOR PLASTICS, A. R. Henning

This paper was presented at the 1953 Convention of the Plastics Industry in Sweden, and constitutes a report from the laboratories of Fibreglass Ltd., Ravenhead, St. Helens Lancs. Since glass fibre reinforced plastics excel through their high tensile strength, high modulus of elasticity and their resistance against mechanical destruction, especially where small wall thicknesses are required. The various kinds of glass fibre reinforcements and their influence on the end product are discussed. The subject of entering good bonding between the glass fibre base and the polyester resins through linkage agents is briefly touched.

CHEMICAL RESISTANCE OF ETHOXYLENE RESINS, K. Meyerhans

Extensive research and laboratory tests were undertaken to determine the resistance of ethoxylene casting resin "Araldit B" against a great number of chemicals, acids and lyes, the effect of salty solutions and the resistance against water moisture. The details shown by the investigation are laid down in a chart: chemical agent and its concentration, temperatures of the attacking chemicals, duration of tests (between one day and 12 months) and the reaction of the test specimen. Further, this chart indicates the extent of impact strength, flexural strength, increase or decrease in weight and volume, plasticization of stock and other remarkable features discovered during investigation.

HYDRAULIC DRIVE FOR INJECTION MOLDING MACHINES, G. Thilenius

A juxtaposition of characteristics of water hydraulic and oil hydraulic drives for injection molding machines and their inherent advantages or disadvantages is followed by the description of a new electro-hydraulic drive for which patent applications have been filed in Germany. A so-called driving piston is moved to and fro by means of a driving motor whereby the hydraulic medium only serves as power transmission means acting both on the mold closing and injection sides. The piston works with two pressure stages: low pressure causing the opening and closing of the mold, high pressure keeping the mold closed and yielding the required injection pressure. Low pressure is automatically switched off upon stepping in of high pressure. This design renders superfluous all valve controls and makes possible fully automatic control of all operational movements by relatively simple means in contrast to mechanically driven machines. Connection of a small spring-loaded accumulator will permit infinitely variable setting of pressure as well as obtaining the required play. No warming up of the pressure liquid which consists of either water combined with a lubricant or a thin hydraulic oil, takes place in this design.

ANNUAL REPORT FOR 1953 BY THE PLASTICS STANDARDIZATION COMMITTEE

A survey on standards issued and under preparation in 1953 in the various fields of application of plastics. Shortly there will be published a small manual for all standards for plastics and related industries.

THE "PLASTIFIKATOR," A NEW PLASTICIZER FOR PVC, A. Vogt

Description of a new plasticizer for PVC-plasticized compounds which compares favorably with roll mills and screw type presses inasmuch as temperature control is easily made and the output higher. Low thermal stresses on the material during gelatinization, no need for heating or cooling during operation (preheating of the machine to working temperature prior to initial operation is the only prerequisite) and throughput of the material in less than one minute are surely factors which will create a ready market for this machine. The material is being fed through the hopper and by means of laterally ar-

ranged screws into the mixing gap between a conical stationary housing and a conical rotating drum where internal friction causes slow heating and gelatinization of the compound. The tube forming on the drum is fringed through the rotating action of the later and, hence, starts rolling which eliminates any entrapped air. Through axial adjustment of the rotating drum the rolling zone can be so set that the rolled material will form into round strips which tend to adjust their diameter to the operation gap of the machine and leave same without suffering further heating through internal friction. These strips may be fed directly to a calendar or into a rotary cutter for granulation. Investigations are under way to lay down the standards for the loss of radiation during operation and the amounts of heat generated in dependence upon k-factor and plasticizer content of the various compounds used in order to get a clear picture of the exothermic situation.

INFLUENCING THE PROPERTIES OF POLYETHYLENE THRU CHAIN RAMIFICATIONS

A condensation of a number of papers presented at the 123rd Congress of the American Chemical Society in Los Angeles, in March 1953.

NEW BALANCES FOR THE PLASTICS INDUSTRY, Harro Taubmann

The functions of several new designs of balances for plastics producers and processors as built by Carl Schenck of Darmstadt, Syntron Co. of Homer City (Pa.) and Hardinge Co. of York, Pa., are discussed. The Schenck balance with optical magnification of weight indication attains a projected length of scale of 7200 mm corresponding to a scale diameter of 2.3 m. Accuracy is within 0.2 per mille. This design also permits optical taring by means of a hand lever which is in no way connected with the weighing mechanism. The filling mechanism may either be operated manually or electronically. This balance may be hooked to a recording device printing on cards, forms or paper rolls, as well as to an adding machine recording and adding up all measured weights over a certain length of time. An automatic blocking device excludes errors or faulty manipulations by the operator. This balance shows the net weight but records the gross weight. Such balances are built for loads up to 200 tons.

Balances with hydraulic scanning devices, weigh-flow and feed devices, etc. are briefly discussed.

STYROPOR — A NOVEL FOAMED PLASTIC, Fritz Stastny

The laboratories of the Badische Anilin- & Soda-Fabrik have succeeded in producing "Styropor," foamable polystyrene, a plastic material already containing foaming agents homogeneously distributed throughout the material. Under the influence of heat the material expands in volume and takes on a microcellular structure and snow-white color. The use of hot water or steam of 100 to 110°C. for heating Styropor has not only been found advantageous—water or steam not partaking in the foaming action—but also reduces the heating time considerably. The specific weight of Styropor may be varied as desired. Styropor is sold in blocks or as granules.

The relatively simple processing methods—cutting or sawing off small size parts from Styropor block material, foaming in hot water or in the case of granulated material prefoaming in hot water and second foaming in metal molds permitting entry of hot steam thru regularly arranged small borings—and use primarily for insulating of cables and wires are discussed and shall be enlarged upon in a later article as far as granulated Styropor is concerned.

COATINGS TO IMPROVE THE SURFACES OF PVC FILMS AND ARTIFICIAL LEATHER, W. Tischbein

Earlier, reference was already made to the use of polyamide and polyurethane coatings for PVC films and artificial leather to counteract possible plasticizer migration, tackiness of surfaces and, hence, subsequent embrittling of the material. Now, experiences gained in applying "Definal M" (for mat surface coatings) and "Definal GK" (for glossy surface coatings) of the Farbenfabriken Bayer, paste products on the basis of adipic acid—butylene glycol, hexantriol and toluylendiisocyanate which are finished by adding an activator, are related. Adhesion to laminates and films is very good. Definal coatings should not be applied to purely white or color sensitive articles since lightproofness is limited. However, these final coatings show excellent resistance to fats, gasolene and oils.

DESIGN OF INJECTION MOLDS, Hans Gastrow

A classification of injection molds is suggested on the basis of their design features subdividing the two main groups:

a. Tools having a parting line vertical to the mold opening direction, in which ejection of the moldings is effected together with runners and sprue, and

b. Molds which de-gate the molding at the time of mold opening and automatically eject.

EXTRUSION OF RIGID PVC TUBES, Edwin G. Fisher, London

A detailed survey on factors to be observed upon extrusion of rigid PVC: compounds used, addition of stabilizers, lubricants, fillers, plasticizers, and mixing as well as granulation processes. The features of suitable extruders—single and multiple screw—are discussed. This article will be continued and shall then deal with dies, take-off equipment and the extrusion process proper.

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GREAT BRITAIN

BRITISH PLASTICS

Vol. 27, No. 3, March, 1954

Abstracter: E. A. J. Mol

FOUR MOLDINGS FOR TV CABINET, pp. 78-81

Molding a TV cabinet in four pieces, to be assembled by metal fasteners has worthwhile advantages, as easier and cheaper tooling because of smaller molds, reduced transport costs, less weight loss per reject, less storage room for unassembled cabinets. The complete cabinet needs 12 lbs. of molding powder, h.f. preheating is used. The molding is done in 1 double daylight 350 tons press and two 250 tons presses, cycle time is 6 min. for top and front moldings and 8 min. for the sides. Care must be taken to ensure that all parts match perfectly to give one cabinet.

ACETATE FOR MOLDED TORCH, pp. 82-83

Description of a right angle torch, introduced by General Electric Co. Ltd. It is molded from cellulose acetate or butyrate in a rather unusual vertical 50 tons press, the assembly and sub-assembly are described in some detail.

FREE DRAWING ACRYLIC CANOPIES, pp. 84-87

Description of different techniques used in forming canopies from acrylic sheets, including a double-skin canopy, consisting of two matched moldings fitting one inside the other with a ¾" interspace, cemented together.

CONTINUOUS DIP MOLDING OF PVC CONNECTORS, pp. 92-93

Flexible PVC Connectors for lavatory pan-inlet pipes are made from PVC-pastes by dip molding. Preheated (700°F.) hollow aluminum formers are dipped 36 at a time for 1 min., after dripping to get rid of the excess paste the connectors, weighing 2½ oz. each, are cured in a 9 feet oven for 10 min. at 350°F. After cooling the connectors are stripped off the formers by hand and trimmed.

PRESSURE EFFECTS DURING THE INJECTION MOLDING OF POLYSTYRENE, S. D. Eagleton, pp. 95-99

The author of this paper, given at the Swedish Plastics Convention at Stockholm, discusses pressure losses in the solid zone of the injection molding cylinder and the effect of pressure on the temperature of the polymer. Pressure losses can amount to 25-

(please turn to page 41)

SECTION NEWS

Edited by

Stanley Bindmen

Jamison Plastic Corp.
71 E. Sunrise Highway
Freeport, New York

New York Forms Reinforced Plastics Group; June Meeting Topic "Irradiation of Polyethylene"

Arthur M. Merrill

Reinforced Plastic Group Formed

The New York Section is in process of forming a Reinforced Plastics Group as a division within the Section. Exploratory meetings with representatives of reinforced plastics companies have taken place, and an organizational meeting was held on June 23 at the Candlelight Restaurant, Manhasset, N. Y.

An encouraging total of 150 members and guests attended the meeting which included a cocktail hour, dinner, business session, and technical meeting. Carl Virgin, Naugatuck Chemical Division of United States Rubber Company, and acting chairman of the Group, presided over the business session. Guy Martinelli, Sylvan Plastics Co. and membership chairman of the New York Section, and Joseph Healey, Manco Products, Inc., and national membership chairman, spoke on the aims of the Society and the value of membership to plastics technologists. An invitation to the representatives of the reinforced plastics firms to join the Section was also extended by the president, Harold H. Schwartz, Empire Brushes, Inc., who introduced the other Section officers and directors.

A talk on "Horizons in Reinforced Plastics" by James A. Lunn, president of Lunn Laminates, Inc., featured the technical session. Mr. Lunn noted that reinforced plastics is still a small industry whose growth has been slowed by many technical problems. Few products made of reinforced plastics are actually in production at present. As production and other problems are solved, the industry can look for expanding markets and sales volumes in such products as aircraft parts, boats, guided missiles, helmets, corrugated sheet, trays and tote boxes, furniture, continuous laminated sheeting, pipe, truck parts, and other defense, industrial, and consumer items.

There was also a showing of the Zenith Plastics Co. sound-color film, "Futures Unlimited," dealing with the construction of airplane radomes and tail sections, furniture, and other products made of reinforced plastics. The meeting closed with a drawing for door prizes contributed by Empire Brushes.

Irradiation of Polyethylene

A talk on "Irradiation of Polyethylene" by P. A. Goodwin, General Electric Co., featured the June 16 dinner meeting of the New York Section. Some 90 members and guests attended the meeting, the last before the summer recess, which was held in the Gotham Hotel and included a cocktail hour and business session.

Irrathene 101, General Electric's irradiated polyethylene, is the first industrial application of radiation chemistry, Mr. Goodwin declared. Made by bombarding polyethylene with high energy electrons, Irrathene 101 has all of the desirable properties of standard polyethylene plus outstanding resistance to stress cracking, and has a cross-linked structure (like thermosets, it chars instead of melting).

The irradiated polyethylene is available only in pilot plant quantities at present, and only in the form of tapes. As the process is further developed, the material is expected to become available in a wide range of film widths and thicknesses. Polyethylene cannot be irradiated prior to molding because of the thermoset structure caused by this treatment.

Because of its combination of properties, the speaker noted, Irrathene 101 is expected to open up new applications in such fields as electrical insulation, food and drug packaging, protective coatings, and others. Above the normal melting point of polyethylene, Irrathene behaves like a vulcanized rubber in that it deforms but does not flow. Although its strength above 110 C. is relatively low, the material has sufficient form stability for many uses.

Mr. Goodwin also reported briefly on the effects of electron irradiation on a wide range of plastics and rubbers, noting that some are improved while others are degraded. Further work in this field is under way, and other industrial applications of irradiation can be expected in the future.

Table favors were distributed through the courtesy of Empire Brushes, Inc., and the meeting closed with a drawing for door prizes contributed by Washington Molding Corp.

The New York Section added 24 new members during the past two months, as follows: R. L. Cantor, consultant; Alan Daniels, president, Baby World Co., Inc.; J. F. Davis, marketing research, American Cyanamid Co.; H. E. Ennis, manager of plastics division, East Coast Aeronautics, Inc.; H. J. Friedman, vice-president, Russell Reinforced Plastics Corp.; W. T. Granger, plastics engineer, United States Testing Co., Inc.; G. W. Hirschhorn, development engineer, Richardson Co.; E. L. Larkin, Jr., sales rep., Monsanto Chemical Co.; R. L. Kern, sales rep., Godfrey L. Cabot, Inc.; G. W. Kozma, plant manager, Admiral Plastics Corp.; Albert Lensky, chief mold designer, Arnkurt Associates; A. F. Mathon, general manager, Jerome Welding Co.; Henri Morgenstern, secretary-treasurer, Cre-O-Plastics, Inc.; W. G. Parker, sales engineer, Fellows Gear Shaper Co.; S. E. Perlberg, eastern rep., Adamson United Co.; John Scheidl, owner, Scheidl Mfg. Co.; J. A. Sciuto, production control engineer, Russell Reinforced Plastics Corp.; G. M. Stephenson, market development, Nova Chemical Corp.; N. E. Talbert, engineer, Polyplastics Division of REF Mfg. Corp.; E. E. Telson, sales engineer, S. S. White Dental Mfg. Co.; F. W. Treeves, regional office manager, Richardson Co.; W. J. Tyrrell, Jr., president, Molding Specialists, Inc.; W. G. Vogel, treasurer, Diemakers, Inc.; and E. I. Webb, chief design engineer, Polyplastics Division of REF Mfg. Corp.

Advances in the Technology of Vacuum Forming Brings Out Record Attendance at Chicago

Robert Butzko displaying vacuum formed Christmas decoration panel

Lloyd E. Parks

"**Vacuum forming** has a place of its own and should not be considered as directly competitive with **injection molding,**" was a strong point of our speaker, Mr. Robert L. Butzko, President of the Auto-Vac Company, Fairfield, Connecticut. Vacuum forming is finding its place and is on the move. Approximately 30 million pounds of plastic was formed in 1953, the current rate of consumption is 45 million pounds per year, and a yearly consumption of 200 million pounds within 5 years is predicted.

Customers, recognizing the place of vacuum formed plastic parts, are beginning to build prints around them. With this progress there is an increased demand for quality parts requiring good sheet stock, better tooling and better control.

Raw Materials:

Raw material suppliers have responded with a wide range of satisfactory sheet stock including the following plastics:

Polystyrene	Cellulose Acetate
Acrylic	Cellulose Acetate
Mylar	Butyrate
Nylon	Vinyl-Rigid
	Vinyl-Flexible

Vacuum forming has advantages when:

1. Detail and dimensional tolerances of the finished product can be sacrificed to a degree.
2. Production run is to be short. Tooling for vacuum forming is much less expensive than tooling for injection molding.

Vacuum forming is being used in 40 to 50 fields including the following:

1. **Lighting:** This field provides the greatest outlet for vacuum formed parts at the present time. Acrylic is replacing glass as the light diffusion panel for fluorescent lighting fixtures. Vinyl and oriented polystyrene are being used for ceiling panels with preference being given to vinyl. Various plastics are being used in a variety of lamp shades and other specialities.
2. **Displays:** This field is continually developing new products and welcomes the low cost of tooling for vacuum forming. Generally, vinyl is used, however, butyrate and acrylic are formed. "Royalite" counter display racks capable of taking extremely rough handling are reported to be ready for the market.
3. **Wallets, place mats, and sundry items:** Previously manufactured from a number of bossed materials are now vacuum formed using metal sprayed molds. Flexible vinyl is used almost exclusively.
4. **Toys:** Drape formed vinyl is replacing rubber in the production of masks, etc. for kids. The cost saving is appreciable. Paint sets and games are being formed in increasing numbers. A 60 inch toy automobile is being vacuum formed.
5. **Christmas Decorations:** About 75% of all Christmas decorations are vacuum formed.
6. **Refrigeration:** A Canadian company has used 25,000 vacuum formed polystyrene door liners in refrigerators. This lot was made on one mold. Breaker strips, butter keepers, crisper trays and freezer doors have also been used in Canada.
7. **Other Appliances:** Drain boards are formed from polystyrene, air conditioning unit shells of formed plastic are being considered, hardware items are being packaged placing the item on cardboard, and vacuum forming plastic over it.
8. **Automotive:** Kick plates, dash boards, arm rests, etc. are being considered.

A record crowd of 207 attended this, our last dinner meeting of the season. The meeting was held at the Western Society of Engineers on May 19, 1954.

Romar Plastics Is Formed

W. A. Hart announces the formation of Romar Plastics, Inc., at 137 E. Main St., St. Charles, Ill. They are molding both thermosetting and thermoplastic materials by transfer, compression and injection molding and carry a complete line of thermoset knobs. Write to above address for brochures.

Gerrie Joins Reinecke Associates

James K. Gerrie has been appointed an associate of Reinecke and Associates, it was announced here today by Jean Otis Reinecke, head of the Chicago product styling and development organization and chairman of the board of the Society of Industrial Designers.

Gerrie, a native of Los Angeles, California, has been with the Reinecke organization since October, 1950. He joined this product styling firm immediately after his graduation from the Art Center School, Los Angeles.

Plastic Tools Used in Corvette Making And Molding of Ethylene Interest Toledo

R. E. Dunham

On March 24 a talk was given to the Toledo Section by Mr. William Weaver of Modern Pattern and Plastics, Inc., Toledo, Ohio. The talk was entitled "Plastic Tools Used for Chevrolet Corvette Production."

Mr. Weaver outlined the use of plastics in tooling. He centered his story around the dies used to manufacture the Corvette, but generalized frequently as to tool applications. The initial models of the Corvette were made using plastic dies and it is surprising to learn that thirty to forty cars per day are still being produced from these dies. Steel dies are being made but the plastic dies will still be usable as standby equipment.

Advantages given for plastic dies are: dies can be made directly from wood models; tooling can be reduced from many months to a short time; prototype can be made soon after models, and dies are much cheaper than metal dies. The major disadvantage is the short service life compared to the service life of metal.

Epons, polyesters, and cast phenolics are the resins currently used. The making of molds is the largest outlet for epoxy resins. Epons set up at room temperature, can be used for thin sections, exhibit low heat distortion, and yield to pressures. Cast phenolics possess low shrinkage, require heat to set, and are dimensionally stable. Polyesters give high shrinkage and are not feasible for use on wood models so as to secure proper dimensions without modification of the models.

Shear edges for the plastic are necessary on the molds. The bag method is commonly used. 50,000 parts can be made from a mold and in two hours a new die can be made. It is common, however, to use a die for only 2,000 parts. It is estimated that 20% of the tools found in the automobile industry are plastic. A common use is for short runs to produce prototype parts. Another is in the preparation of models sent various die shops. Other uses are for matched molds, masters for duplicating, vacuum forming dies, paint masks, drill jigs, and standby mold equipment.

Mr. Harold Holz of the Bakelite Company spoke on April 28 at the regular April meeting of the Toledo Section on the subject "Molding of Polyethylene." This talk consisted of a brief review of the history, manufacture, grades, forming methods, and properties of polyethylene.

Polyethylene is produced from purified ethylene at 30,000 pounds per square inch. Fifteen cubic feet of ethylene could produce one pound of polyethylene. Pressures used are equal to the maximum pressure in the barrel of a standard five inch Navy anti-aircraft gun.

At least forty grades of polyethylene can be made in production, but only about eight are currently available for manufacturing use. Molding fundamentals, mold shrinkage, gating, and other molding variations were reviewed by the speaker.

Applications in the molding field were illustrated with a large number of samples such as pipe, cable, thread protectors, oil can spouts, shoe counters, containers for solid merchandise, toys, housewares, blown containers, and others. The talk was followed by a lengthy discussion period provoked by the many members and guests.

"The Art of Giving a Good Talk" Given by Connelly at Detroit Meeting

J. H. Kuhn

The Detroit Section held their first golf outing of the summer session at the Grosse Isle Golf and Country Club on June 22, 1954. Ideal weather prevailed for the seventy-two golfers of the total one hundred and twenty-five present for the outing.

Jerry Clough, Monsanto Chemical Company, received an award for his low 78. Other golf and door prizes were distributed.

Carl Whitlock, Section president, presented to Bill DeGalan, for his outstanding work as 1953 president, a barbeque set and a set of garden glass holders.

Captain Ted Lindsay of the Detroit Red Wings and Sports Announcer Al Nagler of WJBK showed film highlights of the Detroit Red Wings-Montreal Canadiens Stanley Cup playoffs. An animated question period followed.

The Detroit Section summer session will end with the second golf outing that will be held on September 10th at the Western Golf and Country Club.

Art of Talking

The Detroit Section held their May meeting in the E.S.D. Club Rooms at the Rackham Memorial Building, which was attended by 48 members and 12 guests. We are certain that the 12 guests will become members soon, after having listened to Mr. J. P. Healey, National Membership Committee Chairman, extol the virtues of the S.P.E. In fact, two guests who won door prizes had difficulty in walking off with their prizes without first having turned in membership applications.

The S.P.E. members were pleased to hear from Mr. Healey that the Milwaukee Chapter was reactivated and that a new chapter has been opened in Atlanta, Georgia.

Mr. W. J. Connelly, Assistant Director of Public Relations of the Bakelite Corporation, spoke at length on the technique of delivering addresses before audiences of varying sizes. Mr. Connelly discussed in detail the proper use of visual aids to be used in attracting and holding the attention of audiences and gave us detailed information concerning the need for clarity in presenting graphs and charts. The difference between writing an article for magazine use and writing a talk for public deliverance was clearly explained and understood by the very receptive membership of the Section. This writer could not help but feel that speakers at the National S.P.E. Conferences would do well to take advantage of any opportunity they might have to hear Mr. Connelly. Many of the talks given at recent National Meetings would have been greatly improved and would have been of more value to the audiences had some of Mr. Connelly's techniques been employed.

This meeting was the last of our spring meetings and the next gathering will be our first social event of the year, which is the Summer Golf Party to be held at the Grosse Ile Country Club on June 22nd.

The Detroit Plastic Products Company, East Detroit, Michigan, has announced that Mr. J. A. Cooper, formerly with the H. S. Shaffer Associates, is now representing their company in Ohio and surrounding areas.

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Problems of Management and Competition Discussed at Philadelphia by O'Connell

H. C. Colby, Jr.

Approximately ninety members and guests attended the May 25th meeting at the Franklin Institute. As usual the meeting was preceded by dinner in the Dairy Dell section of the Institute. Mr. John J. O'Connell, President of the Consolidated Molded Products Corporation, Scranton, Pa., was the speaker of the evening. Mr. O'Connell is also the current National President of the Society of the Plastic Industry.

Mr. O'Connell discussed the molders' current problems from a management point of view and mentioned the numerous activities of SPI that are helping molders solve some of these problems. He pointed out that the majority of the molders' problems were common to all molders not only in this country but in Europe as well.

It was pointed out that our rapid growth over the past twenty-five years has been in part responsible for the molder's problem of inadequate capital. Industry growth has far outstripped initial capitalization. Reinvestment of earnings has been limited by high taxes and low profit margins. Low profit margins also make the molding industry unattractive to investors. Rapid obsolescence and high cost of machinery further complicate the picture as does poor management.

Mr. O'Connell elaborated on the subject of poor management, expressing his opinion that the day of the large molder was fast drawing to a close and that we were entering into an era of specialization. He feels that the ideal molder of the future will not only specialize in compression molding, injection molding, extrusion or low pressure molding and the type of product he produces on a proprietary or custom basis but also specialize geographically, limiting himself to a radius of 250 miles from his plant. He pointed out that such a molder would concentrate on a few industries he could serve best and locate branch plants near large customers or concentration of customers in these industries to serve them better.

The molder must remember that his services are largely of a technical or engineering nature which, thru subsequent application of labor, convert plastic materials from one form to another. Mr. O'Connell said this requires the molder to assist in improving performance and costs on machines and molds as well as devising ways to cut down the lead time needed for delivery of this equipment. Also he must regularly add new blood to his technical staff, see that the whole staff is kept well informed technically and compensate them adequately.

Unethical and destructive competition is an increasingly critical problem in the plastics industry. There is very little the individual molder can do about these parasites, however, Mr. O'Connell pointed out that a very promising start has already been taken in this direction through the issuance of A Statement of Principles under which five major associations in the plastics field have pledged themselves and their membership to observe high ethical standards in the design and engineering of plastic parts and in the correct end use applications of plastics. Individual members are also being requested to sign the statement and it is hoped that the consumer in time will express a preference for the products of these producers.

A recent development in our industry has seen the growing number of combinations which have been effected between companies by merger or outright purchase. If our industry follows the pattern established by older industries, we will see a wave of mergers and consolidations following the first period of dynamic growth. This movement seems to offer one form of solution for two of the problems previously touched upon; namely, the lack of adequate capital and the location of additional plants in close proximity to selected selling areas.

Other problems touched upon are being solved by the molders themselves, in some cases acting alone, and in other cases with the assistance of the Society of the Plastics Industry. Currently, the operating divisions of SPI are buttons, molders, machinery, melamine dinnerware, monofilament extruders, mold makers, film and sheeting, polystyrene wall tile, reinforced plastics, thermoplastic pipe and thermoplastic structures. These divisions set up their own program and organization and are subject to the general supervision of S.P.I. Service committees are also established to facilitate the program of the operating divisions such as the Traffic Committee, Public Relations Committee, the Membership Committee and the Accounting and Financial Committee. Special task committees are set up for specific purposes such as the S.P.I. Handbook Committee, the National Plastics Exposition Committee and the Committee on Large Plastics Moldings.

Through its organization and its headquarters staff, the Society offers assistance along these lines:

(1) Establishment of [illegible] product standards and appro[illegible]ed testing procedures.

(2) Creating a body of factual information on which individual molders may safely base decisions. This would include wage surveys, sales surveys, monthly sales reports, operating ratios, depreciation allowances, uniform accounting procedures, labor relations data, union contract provisions, typical trade selling practices and many others.

(3) It assists in promoting better practices among the plants. Better management practices have been discussed at a series of National Molders Management Meetings and out of these have come many recommendations on pension and profit sharing plans, organization and compensation of the Sales Department, fire prevention practices, National Plastic Safety Council, Statistical Quality Control and many others.

(4) It has acted as the industry spokesman to government. S.P.I. has represented the industry in countless hearings in Washington and at the State and Municipal levels on such subjects as price control, material allocations and control, shipping rates, fire regulations, tax hearings, depreciation allowances, small business committee hearings, and the like.

With all this talk about SPI don't forget about SPEAC '55. Our slogan is "PLASTICS GROWTH THROUGH ENGINEERING."

Journal of Commerce Quotes Healey on Business

Under the title "The Plastics Corner" in the Journal of Commerce [illegible] March 31st the Society received recognition and a spread as they picked up some publicity on Joe Healey's visit to Atlanta.

Here's what he told the Atlanta SPE.

"Don't let temporary business declines influence you to sell the plastics industry short as the industry has terrific potentials.

"Its market is constantly expanding and **new developments** are constantly rising to create product efficiencies and economies in many other industries which plastics serve as a partner."

Then Mr. Healy arrived at the crux of his formula:

The way to combat economical setbacks is to concentrate on creative **ideas** which will lead to new applications, rather than engage in price **slashing** (as has been the case in many plastic raw materials recently) and other **destructively** competitive devices. It is the indiscriminate use of these tactics, Mr. Healey thinks, which could mean slow death for the industry. Manco Products, Inc., located in Melvindale, Mich., are fabricators of beryllium copper [illegible] and cavities for plastic molds.

Epon Resins Provide Topic for Milwaukee

Marvin C. Stowe

Guest speaker for the May 11, 1954 dinner meeting of the Milwaukee Section Society of Plastic Engineers was Mr. J. L. Carey who is Supervisor in the Rigid Plastics Technical Service of the Shell Chemical Company. Mr. Carey came to Milwaukee from Union, New Jersey to speak to the Milwaukee Section on Shell Companys' "Epon" resins. Also as guests, representing the Shell Chemical Company, were Mr. James Robbins who is Manager of the Chicago Branch of Shell Chemical Company and Mr. Kenneth Lovell, Jr., Local Sales Representative out of the Chicago Branch. Mr. Carey began his speech with the chemical background of the "Epon" Plastic resins. He then went into the use of these unique resins for adhesives, potting, tooling and laminating. One of the outstanding qualities of the Shell Companys' "Epon" resins is its adherence to various metals, rubber and other plastic materials. It has not only its adherence ability but also it has long lasting durability. One outstanding adhesive job of the "Epon" resin is the attachment of aluminum and rubber. An example of this was passed around. These resins are also used in the laminating field.

This resin has been used very successfully in the encapsulation or potting of many objects. This was very nicely illustrated by a sample of the inners of a radio being encapsulated and an electric motor also encapsulated. Again an outstanding quality of the "Epon" resins which makes successful encapsulating possible is the very low shrinkage of the material. An example was shown of a encapsulated standard 60 watt light bulb. There was absolutely no apparent damage to the light bulb after complete curing of the material. I believe the actual shrinkage of the material is less than one percent in volumetric shrinkage. Probably the most well known use of the encapsulation idea is in the electrical field, for instance for the purpose of inculation.

I would like to mention that the "Epon" resins have good machinability and also have flexibility. "Epon" resins are resistant to corrosive chemicals and have a great deal of mechanical high pressure strength thus making it ideal for use in piping and tanks.

During each phase of Mr. Carey's speech samples were passed around to the audience to illustrate the various points. In concluding his speech Mr. Carey made himself available for questions out of which one full hour of open discussion resulted.

Sixty members and guests of the Miiwaukee Section of the S.P.E. who were present at the meeting enjoyed a fine meal and very interesting and educational speech.

Our next meeting will be September 9.

Education and Polyesters Discussed at Cleveland

Frank A. Martin

The Cleveland-Akron Section met with the Process Industry Group of the Cleveland Engineering Society in their building on May 17th.

The program consisted of a panel discussion of "Plastics in the Processing Industry." Dr. Wm. Von Fischer, head of the Chemical Engineering Department at Case Institute of Technology, was the after-dinner speaker, during which he outlined briefly the history and growth of the industry. Dr. Von Fischer also pointed out that not enough universities are offering training in the plastics fields, and he suggested that the training of engineers for the industry should be encouraged by the establishment of a foundation to be supported by the industry; this foundation to award scholarships and fellowships for the purpose of training young engineers for careers in plastics. His suggestion certainly merits serious consideration.

During the panel discussion, Mr. W. J. Connelly, Assistant Director of Public Relations for Bakelite, covered the uses of vinyls, polyethylene, and flurocarbons in the process industry. Dr. Maurice Bigelow, Superintendent of the Plastron Laboratory, Barrett Division, in his own inimitable style covered the field of thermosets in process industries, and Dr. H. L. Gerhart, Director of Research for Pittsburgh Plate Glass talked on reinforced polyesters. Much of the discussion period centered on the servicability of plastics pipe.

Mr. Crawford was recently elected to the Board of Directors to replace Victor Blatter, who moved to Indiana.

Upper Midwest

The September meeting of the Upper Midwest Chapter of the SPE will be held on the 20th at 6:30 P.M. The meeting will be held at Worwas, 2300 University Avenue N.E., Minneapolis, Minnesota.

Mr. Rex Bradt of the Fiberfill Corporation of Warsaw, Indiana will speak on "The Injection Molding of Fiberglass Filled Polystyrene."

Diagnosis of Extruder Troubles Heard at Newark

D. J. Mullins

Dr. Ernest C. Bernhardt of E. I. DuPont de Nemours & Company discussed "Diagnosis of Extruder Troubles" and Paul E. Schmidt of Panelyte Division, St. Regis Paper Company discussed "The Effect of Injection Speed on Large Molded Parts" before an audience of approximately 125 members and guests at the May meeting of the Newark Section.

Dr. Bernhardt based his speech on his article which appeared in the March, 1953 issue of the S.P.E. Journal and he outlined a simplified extruder flow equation for determining the capacity of the metering section of an extruder and the pressure discharge characteristics of an extrusion machine. Dr. Bernhardt stated that his formula has proved to be the most successful method for calculating these factors and pointed out that the use of this and other applicable equations which he has devised should be used when attacking an extrusion problem.

Mr. Schmidt also based his talk on a previously published article; his essay having appeared in the November, 1953 issue of Modern Plastics. Mr. Schmidt advised that the problem of injection speed is of special importance in molding large area thin parts such as refrigerator door panels, evaporator frames, etc. Mr. Schmidt elaborated on the experimental work which has been done at Panelyte to determine whether improved efficiency realized from higher speeds of injection is commensurate with the cost of necessary additional equipment, such as weigh-feeders, pre-plasticizing units, etc., whether there is an optimum speed of injection above which whether there are any detrimental effects on the molded piece caused by high injection rates and whether the newly designed injection molding machines actually produce higher injection speeds.

The new job clearing house of the Newark Section got off to a flying start. "What's New," the Newark Sections' publication, listed eleven positions for consideration by S.P.E. members.

Ed Soules was congratulated by Newark President, Joseph Bonanno, for the excellent job he turned in during his recent term as Program Chairman. A wide array of door prizes was donated by Rohm and Haas, Lionel Corporation and H. Muehlstein Company. Table favors were donated by Modern Molders, Kenilworth, New Jersey through the courtesy of Helenhart Novelties.

Automotive Application of Plastics Highlight May Meeting at Southern California

Walter H. Kadlec

Automotive applications of plastics highlighted the May meeting of the Southern California Section in Los Angeles. Speaking with considerable authority from the production viewpoint, Mr. Dan A. Ringis, plant manager of Chrysler Motors California, listed 73 different uses for plastics in his company's line of stock cars. The basic materials included phenolics, acrylics, reinforced resins, acetates and aceto-butyrates, vinyls and nylon.

As new resins are developed and established materials are improved, more synthetics will be used to replace metals, Mr. Ringis said. The increase of functional parts in the automobile places greater demands upon quality control and emphasizes closer tolerances in order to operate with matching metal units. He indicated that Chrysler depends almost entirely on outside sources for plastics production and his talk was directed to the custom molders and fabricators in the audience. Any manufacturer, he said, purchasing a great number of diversified products for assembly must be assured of the responsibility of the sources of supply to meet tight schedules. Secondary sources become a necessity to insure uninterrupted production.

Speaking generally of the automotive industry in southern California, Mr. Ringis pointed out that eight major company assembly plants turned out 14 different makes of passenger cars totaling approximately 650,000 vehicles in 1953. The trend toward consolidation of some of the independent producers could conceivably stimulate growth approaching the million mark within a few years.

To date sources east of the Rockies have supplied all the integral plastic parts while local subcontractors in other industries have become established producers of automotive parts. Mr. Ringis encouraged the molders and fabricators to contact purchasing and engineering department of the local plants as the first step in selling service and products and becoming secondary sources of supply.

The speaker also touched on the subject of plastic tooling, especially reinforced resins, as a means of reducing costs and set-up time. The durability of these plastics is being proven in many tooling applications such as stamping dies, jigs and fixtures.

Mr. Ringis started his career with Chrysler in 1931 and has served as chief tool engineer for the Plymouth Division; assistant master mechanic for the Detroit Chrysler Tank Arsenal; general master mechanic for the Dodge Division and later, special representative to the vice president and general manager. His appointment as manager of the Los Angeles plant brought him to California in January 1953.

The attendance of ninety members and guests affirmed the interest of the local plastics industry in broadening its scope of operation.

Southern California Directors

Left to Right—Directors: Al Ray, Paul Erskine, Joseph Potoczky, Harold Dague, Louis Tallman, Walter Kadlec, William Dewar, Speaker Dan Ringis.
Missing: Austin Herbst, Dale McDonald.

Credit: Chas. Zimmerman, West Coast Plastics Distributors, Inc.

Buffalo Hears About Uses of Plastics in Beer

R. W. Miller

The Buffalo Section of the Society of Plastics Engineers toured the Iroquois Beverage Corporation Brewery on May 21, 1954. Approximately 2[illegible] members and guests were conducted through in small groups. Briefly tracing the steps in making beer, the malt is ground then cooked in a cooker with water. From here it goes through a Lauter tub—into a kettle. At this point hops are added. The mixture proceeds through a hop strainer and is send to the hot wort tank. Wort is a liquid which at a certain stage before fermenting, is separated from the solid part of the grain mash. From the hot wort tank it goes into an air conditioned beer cooler room and is pumped into settlers. This room is kept at 48°F. After leaving the settlers the liquid is pumped into fermenters bath of the open type and closed type. Yeast is of course added here from a special strain of yeast kept by the brewery. The fermenting room is also kept at 48°F. The beer now goes to storage cellars kept at 32°F. From here it is sent to the rackers where it is pumped into kegs or bottle at 40°F. After the [illegible] refreshments ! ! ! were served and a question period was held. The question period brought out the following interesting facts.

1. The only difference in Bock beer is in the color.
2. Porter and stout are made from dark barley.
3. Beer is of bottom fermentation, ale of top fermentation.
4. Alcoholic content depends on the amount of starch used to begin with. Beer runs about 3.4% alcohol, ale 4.2%. In comparison to whiskey these percentages figures would just be doubled to roughly 7 proof for beer, 8 proof for ale.
5. Calorie content for beer is less than for a like amount of milk.
6. The Brewmaster of a brewery has a job as long as he makes no mistakes. When he makes his first bad batch of beer his assistant takes over.
7. It was brought out that plastics play a part in brewery operations.
   a. Use of "Koroseal" hose. This does not absorb flavor or impart a taste to the beer.
   b. Use of a "cold grab" adhesive on labels. Placing the bottles in ice water, for you know what, makes the label grip tighter. Hot water removes it.
   c. Advertising displays for bars, vacuum formed outdoor displays and nut dishes in the form of a large bottle cap.

Western New England Has Outing

Shown relaxing in the foyer of the Farmington Country Club following Western New England Section all-day golf outing, June 2, are (l to r): Art Staff, Koppers; Paul Fortner, Dir. of Research, Plax; and Walter Brash, P.A., Plax.

By George Snyder

The annual golf tournament and dinner dance sponsored by the Western New England Section was held June 3 on the beautifully-manicured grounds of the Farmington (Conn.) country club. About 80 persons attended the affair to which, incidentally, the ladies and other guests were invited. Comments indicated the membership unanimously lauded the program committee's decision to make it a "mixed" event, acclaiming it as one of the most successful and enjoyable get-togethers ever held by the group.

During the day, beginning at 11 a.m., mixed foursomes toured the rolling fairways set amongst some of the most picturesque surroundings in New England and highly touted as one of the finest courses in the east.

Under the Calloway system of handicapping, prizes were awarded to Ed Childs (Monsanto) for low net score; Jack Moore (Tennessee-Eastman) longest drive; and Harry Sanders (guest) low gross. Ed Childs picked up another set of laurels for his closest-to-the-pin shot which measured a scant eight feet from the cup on the 175-yard 18th fairway.

S. E. Ohio Topic Is Safety in the Plant

William J. Stranathan

The Southeastern Ohio Section of the Society of Plastics Engineers had twenty members and guests attending the March 27th meeting held in Cambridge, Ohio.

Art Sanford gave a very good all around "word" picture of "Safety" which was the principle subject for the evening.

Mr. Sanford has been connected with safety work in the General Electric Company for twenty-five years in various capacities, of which ten years has been spent in the chemical division. Mr. Sanford is now connected with the Lamination and Insulating Department, which is located at Coshocton, Ohio. The plant has one of the best records in the company, having operated without a lost time accident since October, 1950, nearly five million man-hours.

Mr. Sanford's talk mentioned several safety measures in which injection presses can be made more safe, such as hydraulic as well as electric controls on safety gates and to urge operators to observe these controls. "Ten fingers are ten times more useful than five," stated Mr. Sanford.

Care should be observed when handling heavy equipment, such as molds. Ask for help and never attempt to repair trouble you are not familiar with.

Mr. Sanford stated that he thought safety glasses and shoes are a must to industry and that gloves are a great hindrance around moving machinery.

Plastics Around the World

(con't. from page 34)

50% of the pressure applied by the plunger. It has been demonstrated that lubricants can decrease the pressure loss, they seem to lubricate best at temperatures below their melting points. Even with lubricants, a high percentage of the pressure is converted into heat. Mixing devices necessarily increase pressure losses. The same holds for pin point gates but high material temperatures can be realized due to friction at high velocities (4000 cm sec.)

An idealised injection molding cycle is described and the effect of ram forward time and annealing on crazing is discussed. Long forward times increase crazing, annealing reduces it.

GLASS REINFORCED POLYESTERS. First three of a series of special lectures at the Borough Polytechnic.

1). Types of Resins, E. M. Evans, pp. 100-103

The designation Polyesters is used to cover combinations of unsaturated polyesters and organic monomers. These combinations, preferably in the presence of catalysts, rapidly condense to give a tridimensional structure. No volatiles are evolved, therefore very little pressure is necessary when laminating.

(Please turn to page 42)

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Dear Friends:

Last May, we mentioned the Latin phrase "Ignoratio Elenchi" in our letter to you. We are glad to tell you that Mr. George Martin, Manager of Noma Lites, Inc., Holyoke Plastic Division has received a check for $5.00. He interpreted the phrase as "Ignorance traps one". That is quite close to our "Ignorance of the important point" as "The ignorance is exposed or proved or disproved by an argument that proves or disproves a point not at issue."

That reminds me. Like everyone else, we read the advertising about jobs with which we are familiar. So many of those advertisements show downright disregard for the important points (and the truth sometimes). We wonder how they could be so inaccurate. After all, this plastics business world is a small one and you can't get by for very long with inadequate or misleading information.

Yours for better living with Plastics,

Wayne I. Pribble

P.S. to Underwood: Congratulations on your recent step into matrimony. Don't be inaccurate in your statements at home.

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Plant Eastern Seaboard desires man with complete knowledge and technical know-how of all phases of production and plant operation.
Permanent position with excellent opportunity and salary. Send complete details and resume to Box 2054 SPE Journal, 34 E. Putnam Ave., Greenwich, Conn.

WANTED: Experienced man in Philadelphia Area specializing in plastic extrusion, stampings, or die castings to represent prominent and well established custom molder with capacity for large and intricate parts by injection, compression, and transfer molding. Please reply Box 2254, SPE Journal, 34 E. Putnam Ave., Greenwich, Conn.

EXECUTIVE AVAILABLE: Plant Superintendent or Plastic Engineer. Presently employed. Graduate Chemical Engineer, 24 years experience in the application of Plastics in compression, transfer and injection molding. Excellent war record. Well versed in development and production methods, manufacturing and cost control, tool design, product development and sales problems. Desire permanent position offering greater opportunities. Married and in excellent health. Highly qualified references. West Coast location acceptable. Box 2154, SPE Journal, 34 E. Putnam Ave., Greenwich, Conn.

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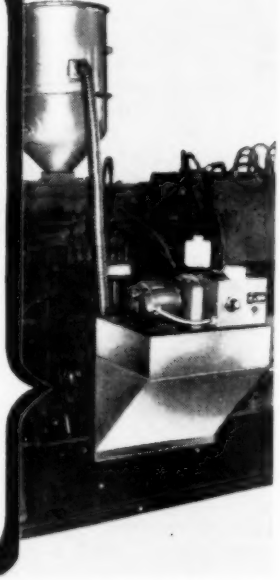
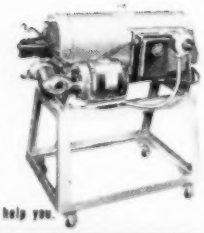
Efficient pre-heating and de-humidifying of material is just one of many jobs done by this timesaving accessory. It speeds production by eliminating handling—because material goes directly to the machine from receiving. No need to load and unload drying ovens. You save floor space, too, because the Hopper-Dryer can be installed easily on standard makes of injection or extrusion machines. Initial cost is less than a drying oven's. Operating cost is low, results are sure.



New Hopper Loader — For continuous automatic feed of any injection or extrusion machine. Clock timer control for starting and stopping. Dust-free operation. **"Die-Temp" Control** — Positive-acting, self-contained mold temperature control at any level between 100-400 degrees F. Fast, compactly built to save space.



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Quality Control

(con't. from page 21)

the piece was very close to the gate of the molded part. The inspector doing the gauging did not notice that the molder had undercut the gate. Inspection of the undersize parts showed immediately what had happened. The molding foreman and inspectors were immediately cautioned on gate removal.

The normality or non-normality of frequency distributions are not always immediately evident. Much has been published on the interpretation and handling of situations where the distribution is not normal, and these details are far too numerous to be readily discussed here. For the reader who is interested in further information, references 1, 2, 3, and 4 are recommended.

REFERENCES

1) Quality Control Handbook—Edited by J. M. Juran Published by McGraw-Hill Book Company
2) Statistical Quality Control—by E. L. Grant Published by McGraw-Hill Book Company
3) Statistical Theory with Engineering Applications—by A. Hald, Published by John Wiley and Sons, Inc.
4) Introduction to Statistical Analysis—by Dixon and Massey, Published by McGraw-Hill Book Company.

Around the World

(continued from page 41)

The most commonly used raw materials, (glycols, fumaric- and maleic acids, adipic- and sebacic acids, phthalic acid, diallylphthalate, styrene, methyl-methacrylate) catalysts (benzoylperoxide) stabilizers (for longer potlife and accelerators are tabulated and discussed.

2). Glass Fibre Forms, A. M. Dobson, pp. 103-5.

Glass fibre reinforcing has only become practical with the advent of low pressure laminating resins, normal high molding pressures lead to crushing of the fibres. The influence and purpose of sizing is discussed. Cloth variables as yarn-construction, weave pattern and cloth construction are considered, the use of roving, diamond mat and chopped strands is explained.

3). Properties and Design of Structures, L. Welch, pp. 105-106

Average glass laminates are compared with mild steel in: specific gravity (1:5), tensile strength (1:2), stiffness (1:10), cost per lb. (10:1), cost per in. (4:1), resistance to corrosion, thermal and electrical insulation, magnetic properties and translucency. The outstanding advantage of glass-resin laminates over steel is the ease of shaping of structures that are curved in more than one direction. Important factors affecting strength are the proportion of resin to glass and the orientation of the fibres. For pressure molding the glass volume should be about 55%, for no pressure molding of woven cloth the glass volume should be about 45% and for no pressure molding of chopped strands about 25%.

Attention is paid to the stabilization of structures by honeycomb sandwiched elements or foamed cores.

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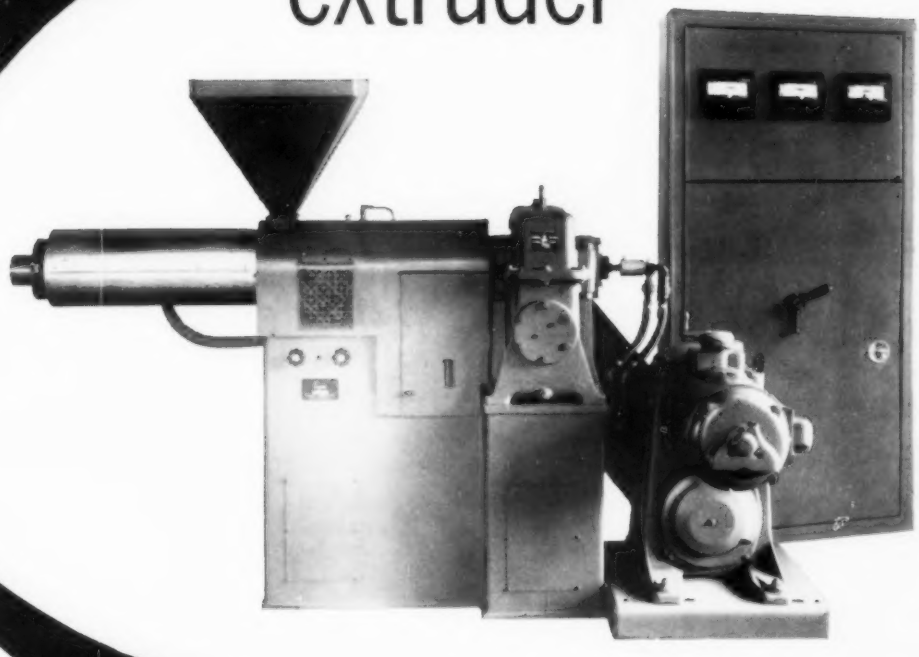
extruder



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